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Electrical Education

HAVING regard to the very great progress made in electrical engineering practice since the beginning of the century, it is surprising that methods of training entrants to the profession, which have undergone so little change during the period, should prove so well able to meet present needs.

That they are effective is no doubt largely due to the qualities of the teachers, to the importance of which Dr. T. F. Wall alludes in his article this week. It is the man that makes the system, as Mr. H. T. Young (President, I.E.E.) put it in a reference to Dr. Alexander Russell at the Faraday House Old Students' dinner a few days ago.

Whether the methods now in general use are the best that can be devised, however, is another matter. There is clearly some doubt among experienced educationalists on this point, as is shown by Dr. Wall and also in the challenging article contributed by Professor C. L. Fortescue to our issue of October 16th.

The first thing is, of course, to decide what is aimed at; the second, the best means of achieving that aim. Professor Fortescue sets us on the path to answer the former by stating the prime requirement as the development of intellectual qualities, which may be assumed to include the "liberal" studies advocated by Dr. Wall this week and by Mr. D. MacLaren Cathcart in our Correspondence columns a fortnight ago, and also the regard for the ethical needs of the student discussed by Professor W. Cramp in his recent British Association address.

All these are essential, even in the most obviously utilitarian way, if an engineer is to maintain throughout his life a mental flexibility that will enable him to appraise readily the value of new ideas and to cope with new situations.

Turning to the means of securing the basis of technical training, Professor Fortescue's suggestion that mechanical subjects are unduly stressed has aroused some comment—as it should. There is, of course, no question as to their cultural value or even their practical utility, since many pieces of electrical apparatus present more mechanical than electrical problems in their design, but is there no danger of making a fetish of a sound principle in allocating to such subjects too much of the limited amount of time available, to the neglect of other no less important subjects? An answer to this query seems to be implicit in his suggestion that different items in the syllabus might be accentuated in different localities.

It has often been pointed out that some of the greatest engineers did not have the advantage of the organised theoretical training that is at the disposal of the student to-day, but, even allowing for the beneficial exercise of the imagination in bridging the gaps in knowledge, we believe they would have done even more in other circumstances.

Genius does not always compensate for lack of training. We remember hearing the late Dr. Ferranti say on one occasion that one could not have too much technical knowledge if one could use it well. A more thorough grounding in fundamentals would have enabled him to carry to a logical conclusion early investigations which would have led to the invention of the induction motor some time before it was actually given to the world.

In his presidential address to the I.E.E., Mr. Young referred to the growing prestige of the graduate class, which now forms more than a quarter of the total membership. This is encouraging in view of the increased expenditure on technical training, but is the money being used in such a way as to ensure that the engineers of to-morrow will receive the kind of training that the profession and the industry require and, we believe, their own keenness deserves?

Liffey Water and Power

The joint scheme of the Irish Free State Electricity Supply Board and the Dublin Corporation for utilising the waters of the River Liffey has now reached the stage when the text of a Bill for its authorisation has been published. Under the terms of this measure—the Liffey Reservoir Bill—the Board will receive a contribution of £126,000 from the Corporation, which will derive a much-needed augmentation of its water supply from the reservoir that the Board is to construct. Incidentally, this should benefit the Board by removing the restraint on building development caused by the insufficiency of the existing water supply. The estimated average yearly production of the hydro-electric scheme is 30 million kWh and the total cost of the work £1,200,000. The recent report of Dr. J. Buchi and Prof. E. Meyer-Peter, of Zurich, however, confirmed an earlier investigation by the Board, from which it appeared that full advantage could not be taken of the project for some six or seven years.

Why Various Prices?

In the October issue of "Bus-Bar" (the London J.E.A. staff magazine) a prize is offered for a 250-word explanation to a consumer when he asks how many kinds of electricity the Authority sells, as the price for lighting is 5d. per unit and that for power and heating 2½d. Most of us in the electrical industry have this problem put to us from time to time, and although we know the answer (or believe we do) it is not easy to put it into a form assimilable by the layman. It will be interesting to see what explanations will be advanced by competitors who, presumably, will be men who are in close touch with the public.

McGowan Report Latest

Amid the rush of questions on important matters that were put to Ministers upon the resumption of Parliament on Thursday last week was one by Mr. J. Chuter Ede, Chairman of the London and Home Counties J.E.A. He wanted to know what action the Minister of Transport proposed to take on the report of the McGowan Committee, and received the more or less enlightening answer that "the matter was engaging the close attention of His Majesty's Government." As the report was published in June and had been in the Government's hands some time before that, we may, perhaps, hope that more definite information will be available shortly.

The Grid in South Scotland

With the introduction in the New Year of a grid tariff for South Scotland, eight of the nine areas for which the Central Electricity Board has adopted schemes will be operating under the grid. The area then outstanding (since no grid scheme has been adopted for the thinly populated district of North Scotland) will be the North-East Coast, where the frequency change-over is likely to prevent trading with the Board for several months. The peculiarity of the South Scotland scheme is that generation will be almost entirely at water-power stations, at which the usual costly storage arrangements have been rendered unnecessary by the ability of the grid to absorb their output as available. In general form the grid tariff is identical with that in force in other areas and the kW and power factor charges are also the same. In those charges that vary in the different areas, *i.e.*, cost per kWh and adjustments for coal prices and rates, it follows Central Scotland, but the basic rates per kW installed are only one-half.

Coal in the Country

It is as well to lose no opportunity of preaching the electrical gospel, and particularly those aspects of it which are hard to "put over." We feel, therefore, that Dr. W. F. Bewley, director of the Cheshunt Experimental and Research Station, is to be congratulated on his ingenuity in dealing with the subject of rural electrification at the recent convention of the Coal Utilisation Council. He based his contribution on the fact that electricity is a derivative of coal—which is true—and put up a good case for electric ploughing, fruit canning, refrigeration and farm power. He also mentioned crop drying and soil heating, but considered that the latter was too costly except for small areas. Such areas, though limited in size, are many in number, and there should be a good market for the necessary equipment among horticulturists and market gardeners.

Pliable Armoured Cable

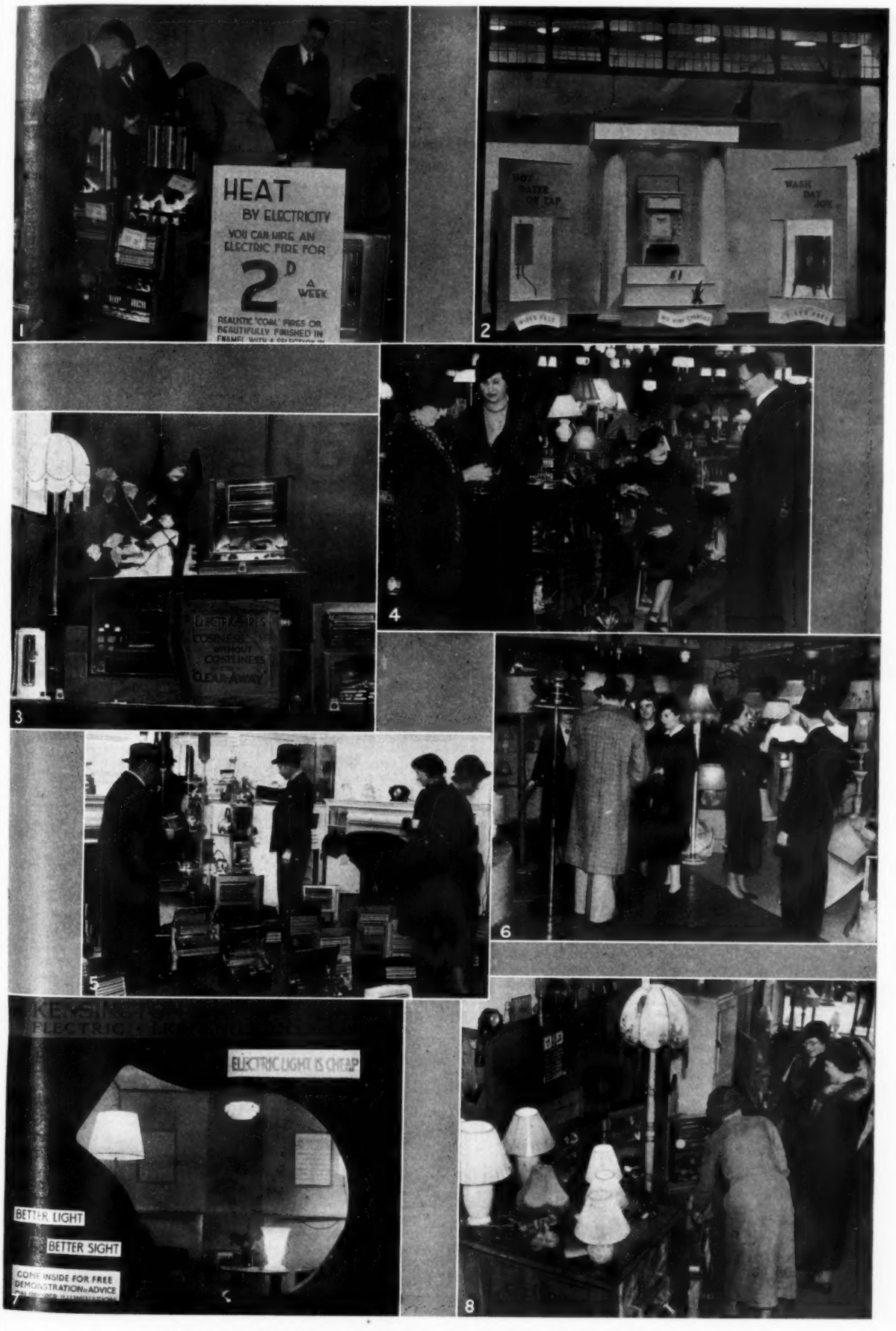
Of the fifty-one fatalities in quarries and metalliferous mines last year, none was due to the use of electricity, although one contractor's man was killed in circumstances which indicate the conductive qualities of wet rope. Those who received severe shocks numbered three of a total of 377 non-fatal accidents. Considering the rapid advance in the use of electricity under arduous conditions (about 4½ h.p. per man in quarries) and the rough handling to which plant and cables are subjected, the electrical accident rate is a minor contingency. Nevertheless, the risk is more pronounced than in most industries, and the need to protect workmen correspondingly great. One of the weak points is the use of t.r.s. cables without earthed metal screens for connecting-up excavators. Pliable armoured cable, as specified in B.S.S. No. 7—1926 and in Mr. J. A. B. Horsley's memorandum included in the report reviewed this week, should alone be employed for such purposes.

Engineering Co-ordination

In his submission that engineering is the basis of civilisation and that one general policy should guide all classes of engineering, Sir Alexander Gibb undoubtedly voiced the opinion of the majority of those whom he addressed last Tuesday. In this he was also in harmony with previous presidents of the Institution of Civil Engineers, who have urged the need of presenting an undivided front to the rest of the world on broader issues. However difficult it may be to secure whole-hearted co-operation in details, even among those in the same branch of engineering, there are, surely, more common points of approach to the major needs of to-day than there are divergencies of outlook. Co-ordination of opinion in these relations would, without doubt, cause far greater attention to be paid by the public at large to the views of engineers as a body of men who have necessarily had a practical experience of life that is based upon a logical understanding of cause and effect.

The Future of Generation

Depletion of the world's fuel resources, once a common topic among engineers, has of late years been relegated to the background owing to the emergence of conditions that have entailed the adoption of a narrower point of view. The subject was raised again in the chairman's address to the I.E.E. North-Eastern Centre of Mr. D. Maxwell Buist, who forecast a ratio of power-station output to fuel consumption of the order of three to two compared with present figures as an aid to the conservation of coal and oil. He referred to the problems raised by the finding of suitable sites for power-stations. Apart from a lack of condensing water, which might be obviated in some cases by the use of large Diesels with cooling towers, there is also the question of desirability of concentrating generation at a small number of points in view of a possible war, which would necessitate reliance to a greater extent upon home-produced fuel. This is an aspect that would not be touched by Mr. F. C. Winfield's suggestion, on a similar occasion last year, that new stations might be built on the sea-coast in association with d.c. transmission. That is not to say that small stations will come into their own again, since the super-power-stations of a decade ago are regarded as small ones to-day. Some of the best of the stations that are closed down will no doubt return to use later, but employing modernised equipment that will make full use of any advantages which these sites may possess.



Autumn Activities: With our Camera-man Around London

1. The Wimbledon Corporation showroom at Malden. 2. A neatly arranged window at Fulham. 3. The Putney showroom of the County of London Co. 4. In Selfridge's electrical department. 5. A fire display at Camden Town (St. Pancras). 6. Choosing lighting fittings at Harrod's. 7. A "Better Light—Better Sight" display by the Kensington & Knightsbridge Co. 8. The Golder's Green showroom of the Hendon E.S. Company.

Cattle and Electric Shock. By O. I. Butler, B.Sc.

The minimum voltage that is likely to prove fatal

FOR some years it has been recognised that the current which flows through the body and the time of duration of the current flow are the most important of the factors which indicate the susceptibility of animals to electric shock. Research work has recently been carried out in America to ascertain the minimum value of electric current which may prove fatal to various species of animals, and in the case of a calf, the largest animal tested, it was found that for a shock duration of three seconds the current that would prove fatal was about 0.2 A. In general, it was found that the larger the animal the greater was the total current required to produce fatal results. We may, therefore, reasonably assume that in the case of horses and cows the minimum value of current which is injurious will be rather greater than 0.2 A. This figure is of considerable importance to all supply authorities in the rural areas of this country, particularly where the transmission towers and poles are erected in fields which are likely at any time to contain grazing cattle.

The unsuitability of indicating susceptibility to electric shock by the applied voltage is due to the widely varying and uncertain conditions of electrical contact, the resistance of which may rise to many times the actual body resistance, according to the condition of the skin, the presence of hair, and the geometry of the applied contact surface. Nevertheless, when considering the death of an animal which it is thought may be due to electric shock, the value of the actual current flow will be unknown, and it is only by establishing a value for the minimum voltage to produce electrocution that any definite conclusion can be arrived at as to whether electric shock has *not* been the real cause of the accident. Due to the increasing use of electricity in rural areas, it is therefore of some interest to establish a value for the maximum voltage which cattle can withstand without injury, and with this object in view I carried out the following resistance tests, in regard to which I would express my thanks to Mr. S. E. Britton, city electrical engineer of Chester, and Professor E. W. Marchant, of the University of Liverpool, for providing the necessary facilities.

First, three horses were tested in turn by means of the Post Office box type of Wheatstone Bridge, the resistance of each animal being measured between its neck and its four hoofs placed in parallel. At the neck, contact was made by thoroughly cleansing and soaking the skin with saline solution, then pressing on to the skin a sheet of flexible metal, while at the hoofs contact was made by means of bandages 2½ in. wide soaked in saline solution securely holding flexible metal sheets to the under surface of the metal shoes. The pressure due to the weight of the standing horse ensured good contact at its hoofs. Bulldog clips were used on the leads from the flexible metal to the P.O. box. The resistances in ohms registered for the three animals were 105, 155 and 225. Varying the mechanical pressure on the neck and making contact on the flesh of the hoof beneath the hair failed to reduce these values, and it may be assumed that they represent actual body resistance.

The horses were again tested after being thoroughly wetted with rain-water, when their resistances in ohms rose to 150, 205 and 250. This indicates that the removal of the natural moisture at the surface of the skin by non-conducting rain-water increases the surface resistance of the body of the animal. However, provided other conditions are such as to ensure good electrical contact, the increased resistance of a horse exposed to rain-water would not tend to reduce its susceptibility to electric shock, since the increased surface resistance results in a greater portion of the total current flowing through the animal.

Mr. O. I. Butler. **A personal note appears on page 657**

Three cows were then tested in turn, contact at the neck being made as before, while at the lower extremities a good flesh contact was obtained by first saturating with saline solution and then tightly binding flexible metal around the hoof immediately under the fetlock, again using 2½-in. bandages soaked in saline solution. The results obtained were 125, 155 and 230 ohms. Thorough wetting of the cows produced no appreciable difference in the results. It is quite probable that lack of any previous exertion, which had been the lot of the horses, left the skin more or less free from perspiration, and so washing down the cows with rain-water produced little change in the surface resistance.

From the above results it would appear that the lower limit of the electrical resistance of cattle is about 100 ohms. This fact, used in conjunction with the minimum injurious electric current value of 0.2 A, leads to the conclusion that a potential difference as low as 20 V, maintained for a period of three seconds, is capable of producing fatal results. It must be borne in mind, however, that this value is exclusive of contact resistance, which may be several thousand ohms.

Electricity in Quarries and Metalliferous Mines

IN order that particulars relating to the use of electricity in quarries and metalliferous mines may be more accessible to those concerned, they are included this year in the annual report of H.M. Inspectors of Mines and Quarries instead of in the separate report of the Electrical Inspector (Mr. J. A. B. Horsley) which deals with collieries. The Report for 1935 which has now been issued (Stationery Office, 1s.) gives the number of quarries, including clay and gravel pits, in which electric motors were in use as 1,135, with a aggregate h.p. of 144,000 (of which 112,000 h.p. was a.c.), representing an increase since 1931 of 287 in the number of such quarries and 40,000 in h.p. (34,000 h.p. being a.c.).

A memorandum prepared by the Electrical Inspector (after discussions with the Cable Makers' Association) on the equipment of excavating machinery in open cast workings is included. In this it is stated that a tough rubber sheath does not alone provide sufficient protection for flexible trailing cables to movable excavators working above 250 V, and protection by an earthed metal screen is called for. The operation of flexible trailing cables at more than 3,000 V is generally inadvisable and unnecessary, as machines up to 100 h.p. can be made for lower voltages; in all cases pliable-armoured cables should be employed.

On three-phase a.c. systems these should comply with B.S.S. No. 7—1926 and have a conductor dielectric of v.i.r. and a sheathing of tough rubber with a minimum equivalent conductor size of 0.0225 sq. in. A fourth core of equal size to the phase conductors is to be provided for earthing the excavator and a similar fifth core, if required, for interlocking or remote control.

It is pointed out that earth-leakage protection is essential for each excavator, to provide against risk of shock; core-balance leakage protection with a three-phase current transformer, having a secondary winding energised when the primary currents are unbalanced due to an earth fault, is recommended, sensitivity being about 10 per cent. of the full-load rating with instantaneous tripping. Leakage protection requires a continuous conductor between the excavator and the earth plate of the neutral of the three-phase system; a resistance between the neutral and earth is conditionally permitted.

Bolted couplings ("flit plugs") should be separated or closed only by skilled persons and after the isolation of the circuit. With free couplings an electrical interlock with the circuit-breaker is required, necessitating the use of an auxiliary circuit (preferably not exceeding 25 V) completed through the earthing conductor in the trailing cable. Insulated coverings of overhead conductors, which guard against corrosion, must not be relied upon as a protection against shock.

Other requirements, such as those relating to isolation, earthing, metal enclosure, are stipulated, and it is stated that the regulations made under the Factory and Workshop Act are inappropriate in many respects for application to plant in the larger quarries. Three non-fatal accidents were caused by electricity during the year, all due to earthing defects. A fatal accident to a labourer not directly employed by a quarry owner was caused by a wet hemp rope, used for hoisting a boring machine, coming into contact with an 11-kV overhead conductor 36 ft. above ground level.

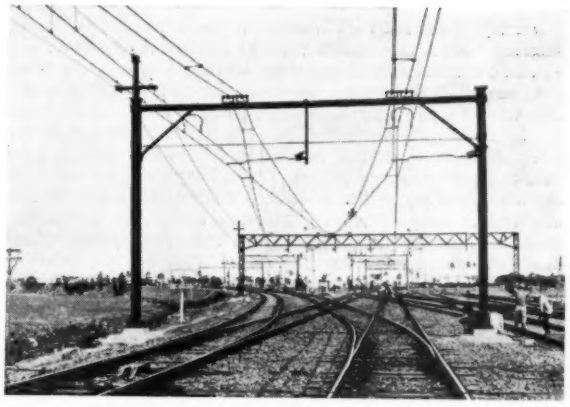
There were 100 metalliferous mines in 1935 in which electricity was used (86 in 1934) to the extent of 34,640 h.p., of which 12,554 h.p. was installed below ground. This represents an increase of 2,480 h.p. over 1934 and 9,510 h.p. over 1931. No accidents due to electricity were reported.

Overhead Equipment for Railways

By H. C. Harris,
A.M.I.E.E., A.M.I.Mech.E.

THE purpose of this article is to describe equipment for modern 1,500-V d.c. overhead contact systems on suburban lines and to discuss the causes of some breakdowns and how to avoid them. My experience has been obtained in India and I wish to thank the Bombay, Baroda and Central India Railway Co., British Insulated Cables, Ltd., and Callender's Cable & Construction Co., Ltd., for facilities obtained from them in the preparation of this article.

The dimensions of bridges and tunnels fix the limits in the design of overhead equipment. The strength of fittings should be graded so that they are weakest close to the contact wire, thus localising damage should the latter break and become entangled with a moving train.



Double- and four-track structures with diabolo-type catenary insulators

Contact Equipment

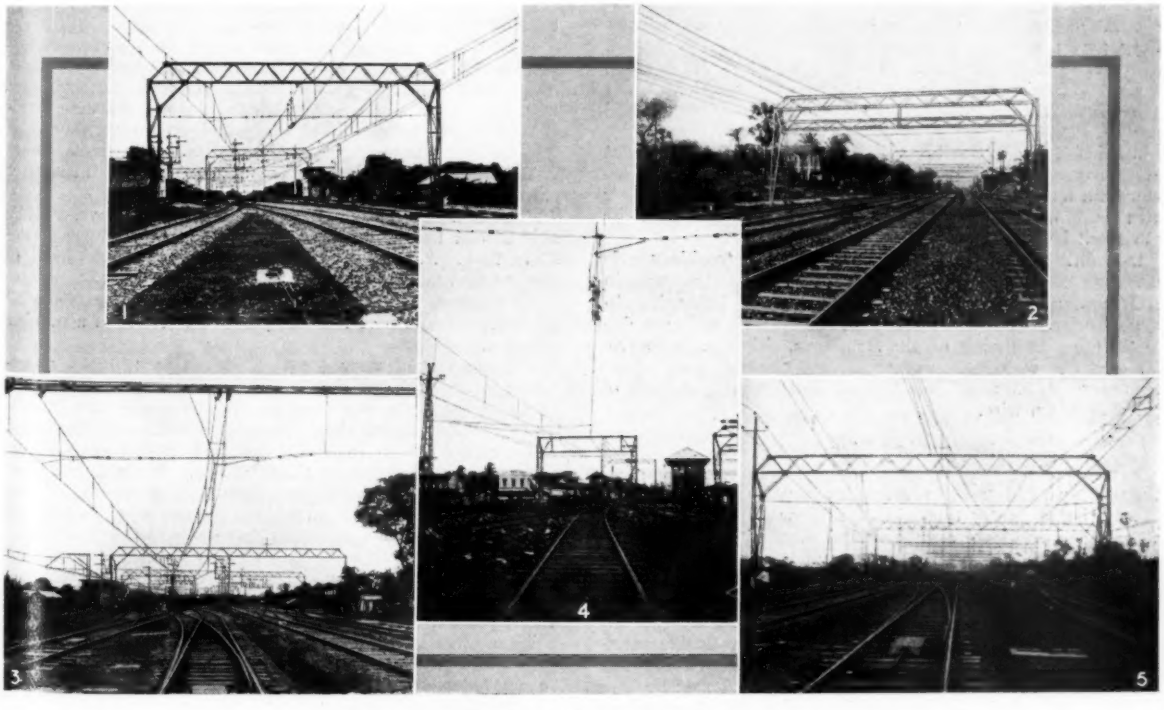
Recent practice on surburban systems with fairly closely spaced stations has been to employ single catenary suspension, with a 0.375 sq. in. stranded copper cable for the catenary and a 0.25 sq. in. copper contact wire having resistances per mile of 0.1165 ohm and 0.176 ohm at 60 deg. F.; the former weighs 8,042 lb. per mile (not including sag) and has a breaking stress of 24 tons per sq. in., and the latter weighs 5,089 lb. per mile and has a breaking stress of 20 tons per sq. in. The span is normally 220 ft. with a catenary sag of between 72 and 75 in. The distance between droppers is 11 ft. 8 in. (12 per span); these have a light looped portion firmly attached to the contact wire, which is the only part of the suspension equipment to rise with the contact wire as the pantographs pass.

When the temperature is likely to vary appreciably, automatic tensioning of the contact wire is necessary. This can be accomplished by springs, or balance weights and pulleys attached to the anchor structures. Attempts were made in the U.S.A. to do without tensioning, but constant severe stretching, due to temperature changes, caused ageing after a short period, and the number of breakages experienced sometimes necessitated complete replacement of the contact wire.

In Bombay, where the temperature seldom varies by more than 10 deg. above or below 80 deg. F. in the shade, no tensioning has been found necessary. Here, on level straight track, anchor structures are about one mile apart. If tensioning wire were to be provided each mile of contact wire would have to be rigidly anchored in the centre, the tension being applied at each end. Anchor structures should be at both ends of important curves, and on gradients of more than 1 in 100 half a mile apart, the upper end of the contact wire being fixed and tension applied to the lower end.

The height of the contact wire above the tracks may be varied by several feet, at bridges, sidings, &c., without ill effect, but the change must be gradual, or the pantographs and overhead equipment will be subjected to excessive strain when a train enters the low section, and will tend to break contact with one another as the train is leaving. The rate of change should not exceed 1 in 50 for train speeds of less than 40 m.p.h., and 1 in 100 for higher speeds. To distribute the wear evenly over the surfaces of the pantograph contact strips the contact wire is staggered about 9 in. on each side of the centre line of the track on straight sections, and about 1 ft. 3 in. on curves, being held in the correct position by means of register arms attached to cross span wires or brackets.

When one track runs into another, or at crossings, one contact wire is liable to be raised by a pantograph passing under it, while another running close to it remains at its original level. In this way the latter wire may slip under the horns of the pantograph and be torn down. To prevent this, either a rigid arrangement of hangers is used which will lift both wires, or both wires are attached to the same register arm.



Types of Railway Overhead Equipment

1. Three-track structure showing junction near entrance to station. 2. Four-track tangent anchor structure complete with equipment. 3. View of station yard showing the method of registering and knuckling contact wire. 4. Two-track anchor structure with contact wire section insulator in the foreground. 5. Special structure as used at stabling sidings

Overlap spans are used between adjacent sections wherever possible. Here, the contact wires of the two sections run side by side for a distance of one span, and the height of the wires is adjusted so that one is gradually brought down into contact with the pantograph shoes at one end of the span, while the other is gradually raised so as to break contact with the pantograph shoes at the other end, both wires being at the normal height above the track at the centre of the span. In this way sparking and wear, which is bound to occur to a certain extent with section insulators, is avoided. The latter, however, are necessary at crossings and other places where overlap spans are not possible.

Short-circuits in the train equipment can cause considerable burning of the contact wire with consequent breakages, for which reason it is essential that every section of contact equipment should be fed through high-speed circuit breakers. Wires crossing the tracks may break and fall across the catenaries, thus holding up traffic on all lines. It is, therefore, most important that wherever possible they should be terminated at each side of the track, and connected by underground cable. Where they do cross they should have a guard net under them. In addition lightning arresters should be at the sub-station ends of every section.

The Insulators

Insulators in most common use for catenary suspension are of the diabolo and suspension types. The advantages of the diabolo type are, first, that the insulating material is in compression, thus being able to stand greater strains and, secondly, that it can be fixed above the cross span, thereby being shielded to a certain extent from the smoke of steam locomotives.

A disadvantage of this type is that birds often cause failures by standing on the structure and making contact with the catenary wire. Suspension type insulators being flexible eliminate twisting strains in the insulating material, and where several insulators are linked together the failure of one may be observed and this replaced before a complete breakdown takes place.

Every insulator is a potential source of failure, and therefore any design for overhead equipment should aim at minimising their number. Failures may be due to cracks caused by rain falling on the insulators immediately after they have been exposed to hot sun, or by the freezing and consequent expansion of moist adhesive material between the insulators and fittings. They may also occur if this adhesive material becomes soft when exposed to the sun. Such failures can be guarded against, if the insulators are tested before use under conditions as near as possible to those that they will experience in actual service.

Tension and compression tests can be carried out without much expensive apparatus, and electric heaters and refrigerators can be used for temperature tests. These will save their own cost if they only prevent one breakdown with its attendant loss of traffic.

In countries where birds are likely to cause trouble guards made up of asbestos sheet are clamped to the structures in such a manner that the insulators cannot be bridged. In some tropical countries crows are a considerable nuisance due to their building nests on the structures. They seem to prefer pieces of wire to any other nesting material, and I have seen several nests in Bombay composed almost entirely of galvanised-iron wire.

Supporting Structures

For supporting the contact equipment with wires for more than two parallel tracks present day practice usually favours the fabricated gantry type of structure, while for double- and single-track cantilever structures and posts with bracket arms are employed. The great advantage of these over suspension from cross-span wires is the localisation of damage due to broken contact wires. Costs can be considerably reduced by building up the structures from old rails. An example of this is a recently electrified line in Bombay, where double cantilever structures constructed of old rails are placed between the two tracks.

The shape and size of concrete foundations for structures or posts depends considerably upon local conditions. Where the soil is soft it is necessary for them to have a large horizontal area, in which case a horizontal pull on the structure tends to force the foundation into the ground on the same side as the direction of pull, and to lift it out of the ground on the opposite side. Deep foundations of small horizontal area are suitable for hard ground, where the surrounding medium is strong enough to resist considerable side pressure.

The first are usually termed "gravity foundations," and the second "side-bearing foundations." The former are usually cheaper to dig, one difficulty with the other kind being in preventing the sides from collapsing, especially where large stones are encountered; another is removing the soil from the bottom of the hole when a depth of about 3 ft. is reached.

The cost of concrete is usually high compared with the cost of excavation, so care in digging to the correct dimensions can affect a considerable economy. A very important part of the cost is mixing and distribution. The mixing should be carried out at the sidings where the concrete can be loaded into special trucks equipped with means for pouring it into the foundations without delay. Much unnecessary cost can be incurred unless these operations are carefully planned. Foundation bolts for structures are set in the correct position by means of templates while the concrete is still soft.

A regular maintenance routine should be planned and adhered to. The following causes of wear may be avoided by the methods suggested:—

Supporting structures should be examined regularly, particularly at the foundation bolts, and any sign of electrolysis should receive immediate attention. This may occur in damp situations where there is a running rail return and where structures are bonded to the rails, due to leakage currents flowing between the latter and earth through the bonds and foundation bolts. These may cause serious corrosion of the latter and cracking of the concrete. This trouble can be prevented by inserting spark gaps to break down at about 200 V between the bonds and the structures or by insulating the structures from the foundations and also from the holding-down bolts.

The frequency with which painting should be done depends considerably upon conditions, and is best decided by experiment. Bituminous paint has been found to be the most effective protection for parts exposed to corrosive fumes from locomotives.

Avoiding Excessive Wear

Wear of contact wire occurs most at fixing points, such as register arms and splicings, and also to a certain extent at starting places due to the heavy currents collected. To avoid excessive wear careful attention should be given to the following points during erection:—(1) Levelling of the wire. (2) Avoidance of kinks in the wire and sudden changes of direction. (3) Proper spacing of droppers. (4) Splicing clamps should be supported off the catenary.

Wear will be caused if the pantographs do not move easily. Their upward pressure should be between 20 and 30 lb., and they should be constructed as lightly as possible, or their inertia will cause wear where the weight of the contact wire is increased by its fittings. For the same reason the weight of these should also be kept as low as possible. Graphite grease in pans on the pantographs can be used to lubricate the contact surfaces.

These pans require topping up about every ten days, and the skin of dirt that forms on surface should be removed at the same time. Automatic pumps for keeping up the level of the grease are now available. Filling hollow tube register arms with oil, and drilling a pin hole for emission of the oil on to the contact wire has also proved successful in a number of cases.

Measurement of wear should be taken monthly by micrometer gauge readings at a scheduled number of points and at additional places every six months. If the contact wire is properly fixed, there should not be a reduction in vertical thickness of more than 0.01 in. per annum, and in the majority of cases not more than 0.005 in. Adverse conditions, however, such as the frequent passing of steam locomotives under the contact wire, may increase the wear to between 0.03 and 0.04 in. per annum. These figures are for 0.25-sq. in. contact wire with copper running strips on the pantograph shoes. As wear is generally less where the wire is not fixed horizontally, the contact wire can be moved along to bring the less worn parts against the fixing attachments.

Wear of catenaries, droppers, cross-span wires and register arms is usually very small, but corrosion must be watched for in salt-laden atmospheres. The contact wire and catenary should be bonded together to prevent current passing through the droppers. Attention must be paid to track alignment, to make sure that the contact wire remains vertically in its correct position in relation to the running rails. In addition, it is important to remember that a small variation in the super-elevation of the outer rail at curves is magnified about five times in a sideways direction on the contact surfaces of the pantographs.

To secure the safety of workers in sidings where work is carried out on the tops of coaches isolating switches with an earth position should be provided. When repairs are being carried out on the overhead equipment, it should be earthed on both sides of the worker.

The Training of Electrical Engineers. By T. F. Wall, D.Sc.

A broader view essential

THE immense amount of attention which has been given in recent years to the problem of training engineers shows that there is a widespread feeling that all is not well.

It is not that the modern university and technical college are deficient in lecture and laboratory opportunities to enable students to obtain a thorough grounding in the fundamental principles of their profession. Never was money more lavishly spent both by public bodies and private benefactors for the endowment of technical institutions.

The sumptuous and gigantic technical institutions which are either in course of erection or are now being planned provide evidence of the determination of those in authority that nothing they can do shall be wanting to make the opportunities for technical training in this country equal to any in the world. The uneasiness which is constantly being shown at the various meetings of associations which are concerned with education, either directly or indirectly, is caused by the disturbing possibility that we are not altogether on the right track.

Whilst being in complete agreement with the greater part of Prof. C. L. Fortescue's thoughtful and closely reasoned article on this subject in the ELECTRICAL REVIEW of October 16th, I would like to refer more particularly to certain aspects which have not been considered by him—at least, not in any detail. Obviously, the whole subject is so wide that many columns would be required to examine it in all its features.

In his presidential address to the Educational Science Section of the British Association this year Sir R. Livingstone made some searching comments on educational methods among the most arresting of which is the following:—

> "At present life is so arranged that most of us do our thinking in youth at an age when we are not best fitted for it, and having left the university think systematically no more. What wonder that middle life finds so many men unaware of recent progress in their own field, unapt for new experience and ideas, deeply embedded in their rut, while progress waits impatiently for their death and the arrival of the next generation."

If this is a correct reading of the signs, the question arises whether those institutions which are responsible for the training of youth have not neglected a vital part of their work by concentrating too exclusively on technical training alone.

The electrical engineering industry needs to-day, more than ever before, men of liberal education as contrasted with technical experts; men of trained judgment and wide knowledge, able to express their opinions clearly, and able to take a comprehensive view of the possibilities of schemes for which the data available are meagre and vague. The curriculum of their training should recognise these requirements and provide some tuition in the weighing of evidence, the probing of motives, and the estimation of bias.

On June 12 last the Rice Road, Schenectady, was dedicated to the memory of E. W. Rice, Jun., and an a historic boulder placed as a marker for the memorial road is inscribed:—

> "A great pioneer of the electrical industry who had the vision, competence and patience of the investigator—the daring and the restraint of the practical engineer."

It may be asked whether it is not part of the duty of those institutions which educate the young electrical engineer to awaken the vision and to inculcate competence, patience, daring, and restraint. Whatever view may be taken of the national schemes and methods of those countries which are ruled by dictators there can be no question as to the amazing activity which is being shown in educating their youth in directions which are not usually associated with technical training.

It is not difficult to formulate a scheme of technical training which will cover the essential fundamental principles which must be studied by all students, as well as to outline the scope of a syllabus for those who will eventually specialise in industrial research. Syllabuses of these kinds, however, will not cover all the responsibilities of a college as regards the education of the electrical engineer. Indeed there are competent judges who believe that if these are all, the student will be deprived of a part of his training which is of prime importance and without which he is but partially prepared for taking the position in life which he is not only entitled to expect, but which it is of national importance that he should assume.

In a recent and widely reported speech the Archbishop of Canterbury observed:—"Life is increasingly difficult and confused and the very foundations of civilisation are cracking." This is, however, not a new national experience; in many respects there is a close parallel between the conditions to-day and those of the Elizabethan age, and the qualities called for are not very different to-day from those required then. It has been noted that many of the great industrial firms upon which the reputation of this country was built were founded by young men in their twenties who to-day would be regarded as mere boys.

Although in the field of engineering it is almost impossible that such a thing could be done to-day for more or less obvious reasons, it is difficult to believe that the fundamental qualities which secured success 100 years ago are very different from those which to-day will also lead to success. Prof. Whitehead points out that we need not aim to produce great leaders because a great society will always throw up great men for the occasion. Ours is the task of establishing a great society in which creative thought and living may flourish.

One of the most remarkable industrial features of post-war years is the attention which so many large industrial concerns are giving to the training and welfare of their employés, particularly the boys and young men, who are encouraged to improve their skill, to take care of their health and to broaden the scope of their general education. One is entitled to inquire whether the university and the technical college are as conscious of their responsibilities to promote the development of mind and spirit to conform with T. H. Huxley's famous definition of the educated man.

A view of Sheffield University, where Dr. Wall is lecturer-in-charge of the Electrical Engineering Department

With regard to the strictly technical aspect of the training of electrical engineers the scope may be considered in three main divisions, viz.: (i) Instruction in the fundamental principles of electrical engineering leading up to the ordinary bachelor degree. (ii) Instruction in the more advanced principles and their applications, leading to an honours degree. (iii) Instruction in the methods of research leading to the degree of Ph.D. This course will usually be taken by a relatively small number of students who show special aptitude.

Although much discussion and hostile criticism have been directed at the degree of Ph.D. as conferred for post-graduate research, there can be little question that the course of instruction in the methods of research which is the main qualifying requirement for this degree is of great value to those students who expect to earn their living as research workers in an industrial or Government establishment.

It can hardly be doubted that some kind of apprenticeship in a large engineering works is an essential part of the training for all electrical engineers. By such experience they will be able to see how large machines are manufactured, to understand the organisation of a large industrial undertaking, to have contact with the men who actually design and construct the plant, to realise what superb skill and craftsmanship such men are capable of, and to become familiar with the routine by which engineering products are produced, tested and despatched. Perhaps the ideal way in which such experience may be obtained is to enter the works for a short period before commencing the college course, to spend the summer vacations in a works or power station, and then to return to the works for from one to two years after graduation. Whatever branch of electrical engineering a student may eventually take up his

value cannot but be enhanced by a sound foundation of practical experience.

A development which was the direct outcome of the experience of the war was the formation of the Advisory Council of the Department of Scientific and Industrial Research for the fostering of scientific research as applied to industry. Industrial research has now become a profession and many large firms have highly organised research departments with a full-time staff. The commercial success of these departments has more than justified their establishment, and it is in the highest degree unlikely that any such industry will be able to afford to return to the conditions which obtained during the extraordinary era of prosperity which followed the industrial revolution and lasted until the outbreak of the war.

The Qualifications of Teachers

It is no doubt appropriate to make some reference to one of the most important of all aspects of the training of electrical engineers, and that is the qualifications of the teacher. Teachers should be chosen for their ability to teach and should be selected on evidence of this ability and not on the strength of academic degrees or reputation for research. The first business of a teacher is to teach and the quality of the product of any scheme of electrical engineering training will depend on the quality of the teacher. The competent teacher will be absorbingly interested in his subject, continually looking for new points of view, with the imagination to foresee and appreciate the difficulties of the most diverse types of students, realising that slowness of perception is often a quality of a profound mind.

Perhaps more than is the case in any other branch of applied science, the teaching of electrical engineering has peculiar difficulties which are not always appreciated. A definite effort of the imagination is necessary to obtain some satisfactory conception of the way in which electricity moves and transmits energy. None of our senses enables us to perceive electricity. The difficulty was expressed in the self-revealing remark of the student who confessed that he was not "electrically minded" and was completely unable to grasp the principles of applied electricity.

The vector and other graphical methods developed by that great teacher Gisbert Kapp and his contemporaries for the elucidation and solution of electrical problems helped to place the science of electrical engineering on a solid foundation and made it possible for the average electrical engineer to investigate and understand the performance of electrical machines and apparatus and, in fact, largely contributed to the very rapid growth of the electrical industry.

In a similar way the graphical methods developed in more recent times by Rüdenberg and others provide means for the solution of many advanced problems of the greatest practical importance, *e.g.*, transient arc and spark phenomena and problems of stability which otherwise would be beyond the ability of any but mathematical specialists. Such methods are found to be peculiarly satisfying to the average student of electrical engineering.

Individually Air-conditioned Flats

With electric cookers and refrigerators

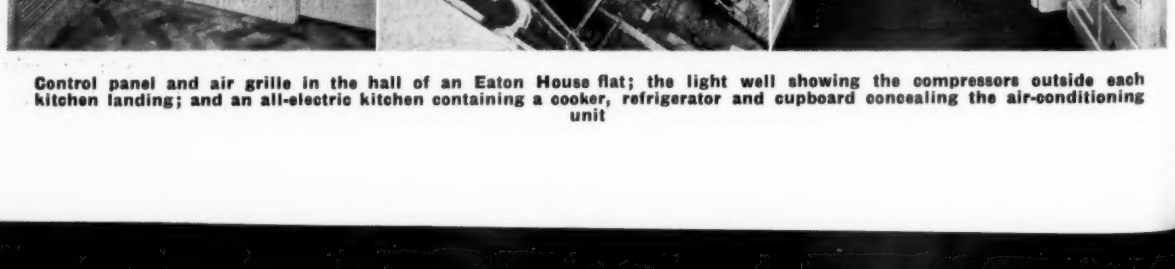
EATON House, Upper Grosvenor Street, is claimed to be the first block of flats in Europe giving each tenant individually controllable air conditioning. This has been achieved by the installation of entirely separate York Shipley air conditioners for each flat, the necessary hot water only being supplied from the ordinary central hot-water plant in the basement. The actual running costs are said to be less than 2s. 6d. a week.

The plant in every flat consists of one "York Freon" condensing unit working in conjunction with a vertical air-conditioner. This comprises a slow-speed fan and motor, heating coils, cooling and dehumidifying coils, air filter and humidifying spray for winter use. The condensing units are fixed outside the kitchen landings, which range round the light wells. The air-conditioners themselves, occupying a floor space of 3 ft. by 2 ft., are concealed among the general fittings of the kitchens. Approximately 1,300 cu. ft. of air per minute is handled by each conditioner (about twelve air changes per hour), and in peak summer weather a drop in temperature between inside and outside conditions of 8-10 deg. F. may be obtained, with a suitable lowering of the relative humidity of the air.

Owing to height restrictions and the fact that Eaton House was actually designed before the air-conditioning plant was installed, the means of providing concealed ducts in the building is of considerable interest. As it was impossible to provide false ceilings to conceal the duct work, the engineers decided instead to design it to harmonise with the architectural requirements of each room. Accordingly, in many cases the ducts are treated with expanded metal and plaster to represent beams, each branch terminating in a diffuser grille at a high level in the room. Return air is taken from the hall of each flat by similar grilles fitted at a low level.

The individual controls for each plant are located on a neat instrument board in the hall. This consists of a thermostat, a humidistat and a change-over rotary switch which together control the supply of hot or cold humidified or dehumidified air as required. The main operation of the plant, which is practically noiseless, is fully automatic, and the arrangement of the equipment leaves the "Freon" in the evaporator unaffected by the heat from the heating coil when the latter is in operation.

In addition to the air-conditioning plant every flat is provided with a Jackson cooker and a Frigidaire refrigerator, and the show flat is rendered particularly attractive by the installation of Berry's "Magicoal" imitation coal fires and a number of period lighting fittings supplied by Trollope & Sons. The building is also equipped with a Siemens intercommunicating telephone system. G. E. Taylor & Co. carried out the electrical work.

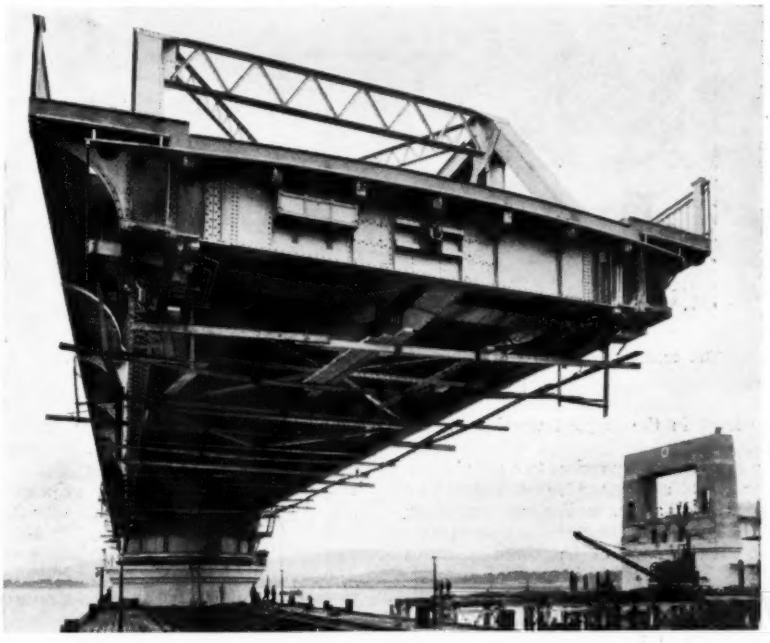


Control panel and air grille in the hall of an Eaton House flat; the light well showing the compressors outside each kitchen landing; and an all-electric kitchen containing a cooker, refrigerator and cupboard concealing the air-conditioning unit

Kincardine-on-Forth Bridge

A 1,600-ton electrically-operated swing span

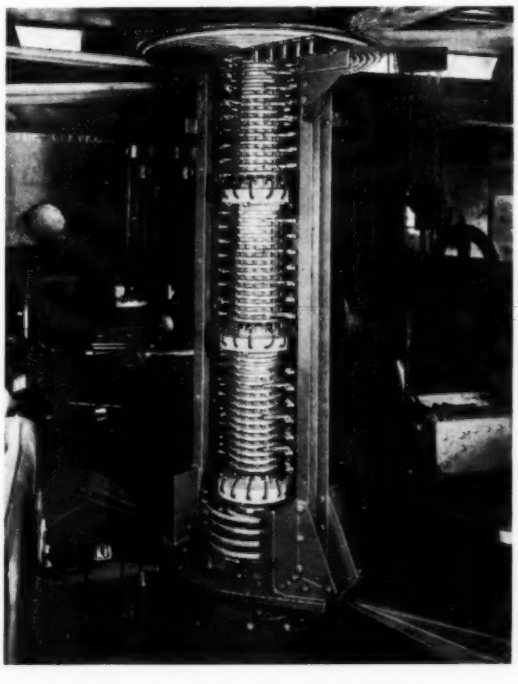
PRIOR to the completion of the Kincardine-on-Forth bridge, which was officially opened on October 29th by the Conveners of the counties of Fife, Stirling and Clackmannan, the only means of crossing the river for road vehicles was the ferry at Queensferry or the bridge at Stirling. Between these the new bridge, half a mile in total length, has been constructed. The chief electrical interest is concentrated in the central double-cantilever span, 364 ft. long and weighing 1,600 tons, which rotates on a pier to provide two 150-ft. wide shipping ways. The bridge operations are controlled electrically from a cabin situated 30 ft. above the roadway in the centre of the swing span.



End view of the swing span showing the photo-electric cell box mounted just below the road level. The bolt in the centre and the two wedges at each side can also be seen

The machinery room beneath the road of the central span contains two 50-h.p. d.c. motors driving the rack-and-pinion turning gear of the swing span in conjunction with an 80-kW Ward-Leonard set. As stand-by an oil engine driving a 25-kW alternator and a 27-kW d.c. generator is installed. There is also a 25-h.p. hydraulic pump supplying oil under pressure for operating the aligning bolts and wedges.

Sliding connections for the incoming supply and the outgoing control cables are provided by a slip-ring column with sixty rings bolted to the fixed pivot (round which the span rotates) in the centre of the engine room, the brush gear rotating with the span. The whole is enclosed in sheet steel and access is obtainable only when the main supply is cut off; withdrawal of the door bolt on the casing automatically trips the main motor-operated oil circuit-breaker (opened and closed from the control cabin), which is installed on the shore end of the bridge and connected to the collector by a Pirelli-General submarine cable. If the main supply should fail, the swing span can be moved at half speed by supplying the two driving motors in series from the stand-by d.c. generator while the bridge lighting is obtained from the alternator.



Slip-ring column in machinery room (cover removed)

The main switchboard in the control cabin is in three sections. The first controls the Ward-Leonard set and carries contactors and isolators for lighting, heating and auxiliary circuits; the second controls the generators, accelerating and slow-down relays for turning; the third comprises traffic-gate and pump-motor panels, wedge and bolt synchronising gear and relay panels for the turning apparatus. On the operator's desk are mounted the main control hand-wheel, master switches and push buttons and 37 indicating lamps.

Above the hand-wheel is an 18-in. dial which indicates the position of the swing span at any point of travel through 90 deg. It is driven by one of the bridge turning motors through the medium of a pair of "Twyntorq" machines. Three smaller indicators show the positions of the two bolts and four wedges. The operator's control over the automatic sequence of operations is solely through the handwheel, which transmits an impulse to one of the two pilot motors (one for each direction of span rotation) driving a main drum controller inside the desk. The drum motion is held up, however, to await the completion of each operation, progress being indicated by the lamps.

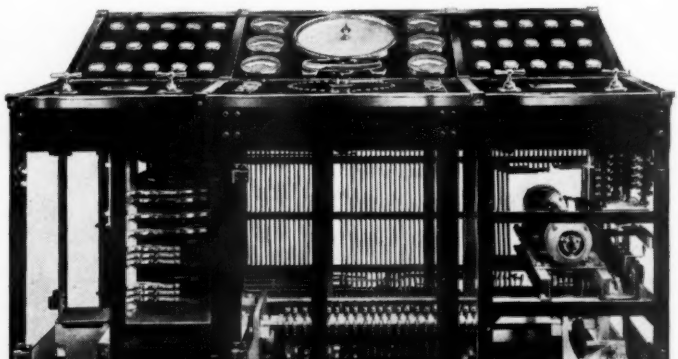
Eight notches are provided in each quadrant of the hand-wheel control so that the operator is able to carry out a partial sequence only if required. For a complete opening sequence the wheel is turned through its full 90-deg. travel, the contactor of the appropriate pilot motor closes, together with a relay determining the direction of the span movement; the motor generator runs up and a voltage contactor closes, remaking the pilot circuit and allowing the drum to resume its travel. At the second step the motor of the hydraulic pump (with suction valves open) comes into operation. Movement to the third stud changes the colour of the traffic lights and rings warning bells. No further motion occurs until a signal has been received that all traffic is clear of the central span. The next three sequence stages cause the gates to be closed, one semaphore to be lowered (indicating that in four minutes the bridge will be fully opened), the wedges to be withdrawn (by dropping the solenoid-controlled pump suction valves on to their seats) and the bolts to be pulled back. The pump motor is allowed to stop. The generator is then free to supply power to the turning motors in parallel for swinging the span which is done in the seventh step.

As the span approaches the open position the motors are gradually decelerated and the main circuit is opened allowing the bridge to come to rest under its own momentum. At the last stud, the second semaphore is operated and a syren gives an "all-clear" signal to shipping. The closing sequence differs only in the order of working.

The wedges are synchronised in order to avoid the strain on the structure that might follow marked difference in position. Each wedge drives a potentiometer regulator energised from the d.c. exciter. One regulator at each end of the bridge has two independent face plates to tying the wedges at the two ends of the bridge span. Duplicate travel indicators, consisting of voltmeters connected between one end of each potentio-

meter and its moving arm, are installed in the machinery room and on the control desk. Between the moving arms of each pair of potentiometers is connected a polarised relay which remains in a neutral position when its two contact arms are connected to corresponding points of their resistances. A difference of 2½ in. is enough to deflect a relay resulting in the shutting down of the pumps supplying the sound wedges and lighting a warning lamp until equilibrium has been restored. A similar arrangement is used for synchronising the bolts.

The accurate alignment of the swing span necessary to enable the bolts and wedges to be shot is secured by the use of photoelectric cells (their first use, it is believed, for such a purpose) with stand-by target-light sighting. The latter is effective except in the foggiest weather experienced in the district.



The control desk showing the pilot motors (right) driving the main drum controller

The equipment in the former case comprises two metal lamp boxes for providing a source of steady light, one mounted on each abutment below road level, and a similar box containing three caesium photo-cells mounted on one end of the moving span at the same level. Each lamp box has three apertures along its lower edge behind each of which are three electric lamps and a narrow slot with a single lamp above the middle aperture. The photo-cell box has three apertures, two at the same level as the lower ones in the lamp box but further apart and the third centrally at the level of the single-lamp aperture.

As the swing span approaches alignment, the first photo-cell is actuated by passing across the outer lamp aperture and operates a relay, which lights the left- or right-hand lamp of three mounted on the control desk, and a single-stroke bell. The same photo-cell passing across the other two apertures gives two further signals. Immediately afterwards the higher-level photo-cell comes opposite the single-lamp aperture, causing the centre lamp to light up, indicating correct alignment when the bolts and wedges can be closed. A slight overshooting of the span brings the third photo-cell opposite the last lamp aperture and lights up the other indicating lamp. Each photo-cell is associated with an Osram amplifying valve.

The photo-cell equipment also de-energises the turning motors. As, however, the momentum of the span varies with weather conditions, creeping-speed and inching-torque buttons can be operated, the sequence being held up pending the working of the photo-electric centring gear, the relay of which may be short-circuited in the event of its failure.

Illumination of the stationary sections of the bridge is provided by twenty-five 300- or 500-W lamps in 20-in. diameter spherical lanterns mounted at 18 ft. in staggered formation at from 100 to 150 ft. intervals; non-axial asymmetric prismatic glass refractors prevent dazzle to navigators. For the swing span six 500-W dock lanterns with special cut-offs are used.

The bridge was designed by Sir Alexander Gibb & Partners and constructed by the Cleveland Bridge & Engineering Co. The control gear in the swing span together with the traffic signals, warning devices and lighting installation was manufactured by the General Electric Co., Ltd., the photo-electric equipment being designed by the Witton-Kramer Department.

The two 50-h.p. motors for driving the turning mechanism and the Ward-Leonard set were supplied by Laurence, Scott & Electromotors, Ltd., who also provided the emergency d.c. and a.c. generators and exciter, the 25-h.p. hydraulic-pump motor and the two 5-h.p. gate motors. For driving the emergency generators a 120-h.p. horizontal-opposed cylinder oil engine with remote control panel has been installed by the Brush Electrical Engineering Co., Ltd.

The South Scotland Electricity Scheme

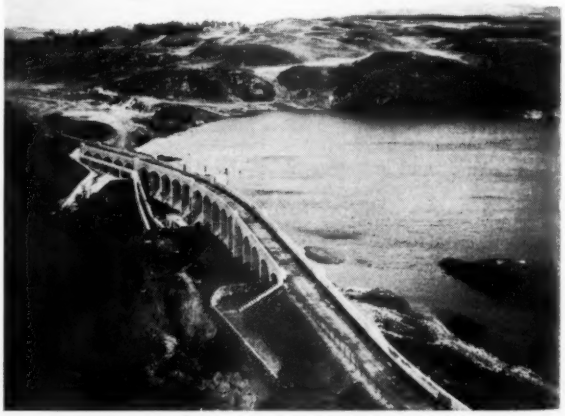
GENERAL trading under a statutory tariff of the Central Electricity Board will begin in the South Scotland grid area on January 1st. This area covers 4,308 sq. miles, including the counties of Wigtown, Kirkcudbright, Dumfries, Roxburgh, Berwick and Selkirk and parts of Lanark and Peebles. Much of the territory is forest and moorland and the population of 253,664 represents the low average density of 59 persons per sq. mile. Agriculture, dairying, sheep farming and woollen manufacture are the chief industries.

The energy generated in the area will be supplied from the five hydro-electric stations of the Galloway Water Power Company now completed with an aggregate capacity of 102,000 kW and from the Galashiels steam station of the Scottish Southern Electric Supply Co., Ltd. Two of the water-power stations, at Tongland and at Glenlee, have been in operation since the summer of 1935; the others at Kendoon, Carsfad and Earlstoun are now being brought into commission.

The grid transmission system in South Scotland comprises about 230 miles of primary lines and about 142 miles of secondary lines. In the west it is linked up with Central Scotland and North-West England by a line running between Kilmarnock and Carlisle and interconnecting the Galloway water power stations and, in the east, it is linked up with Central Scotland and North-East England by lines connecting the Galashiels station with the Portobello station of Edinburgh Corporation and the Dunston station of the North-Eastern Electric Supply Co. near Newcastle.

Grid points have been established throughout the area to afford supplies of electricity to both urban and rural communities as, notwithstanding the sparsely populated territory, much enterprising electrical development has been undertaken by the distribution authorities. The sales of electricity in the area have increased from 5,113,000 kWh in 1926 to 20,760,000 kWh in 1934, representing a growth of 306 per cent.

The grid tariff will include a charge for the basic demand of the undertaking (*i.e.*, its m.d. in 1932 or 2,000 kW whichever is the greater) of £3 10s. per kW, and charges for increments of demand (depending on the size of undertaking) of £3 5s., £3 and £2 15s. per kW. These charges will be varied by 4s. 6d. for each 0.1 by which the power factor is below 0.85 lagging, and 1s. 10d. for each 1s. by which are local rates are above or below 3s. per kW of plant installed at selected stations. The running charge of 0.2d. per kWh supplied will be varied by 0.001d. per 1d. variation in cost of fuel (11,000 B.th.u. per lb.) from 13s. 6d. per ton.



A recent picture, taken from the air, of the Loch Doon dam, near Dalmellington. This is an important part of the Galloway water-power system which forms the major part of the South Scotland scheme

Steel Castings

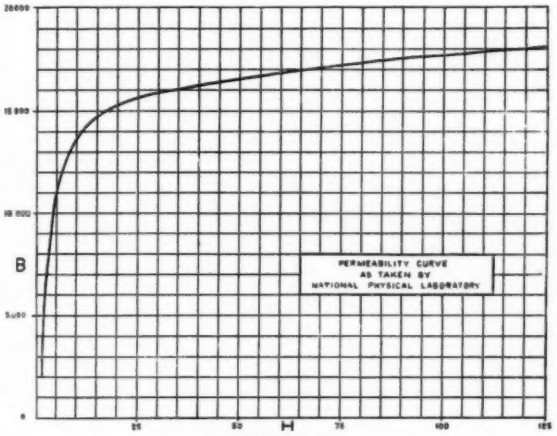
For the electrical and allied industries

THOUGH " garden cities " are not usually associated with the heavy-metal industries, the extensive foundry at Letchworth, Hertfordshire, of Messrs. Kryn & Lahy (1928), Ltd., is ranked among the foremost in the Southern Counties and is chiefly engaged in the production of steel castings.

This concern is connected with J. Browett Lindley (1931), Ltd., power plant manufacturers, whose works were described in our issue of March 6th of this year.

The factory was established in 1915 as a means of employing Belgian refugees. Shells were then the primary interest, but the increasing demand for steel castings and the presence among the workpeople of many skilled moulders led to the erection of the steel foundry in 1916. Peace-time conditions caused the substitution of an entirely British staff and also brought new outlets for the concern's productions, among which castings for the electrical trades became an important part. Since then a wide variety of work has been carried out for some of the largest electrical manufacturers. The accompanying illustrations show recent examples of such castings, and particular attention may be directed to the frame heads for traction

Pouring moulds at the Letchworth foundry of Messrs. Kryn & Lahy (1928), Ltd.



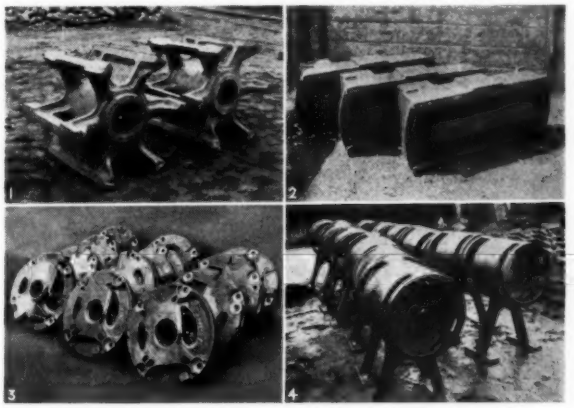
Permeability curve

motors, which are perhaps the most difficult castings employed in the manufacture of traction motors.

The main foundry building consists of two wide bays over 700 ft. in length with the steel-making plant centrally situated in the light moulding department. The building is very fully equipped with a variety of modern plant designed to reduce the cost of production. The pattern shop and the compressed air, oxygen and acetylene generating plants occupy adjacent buildings.

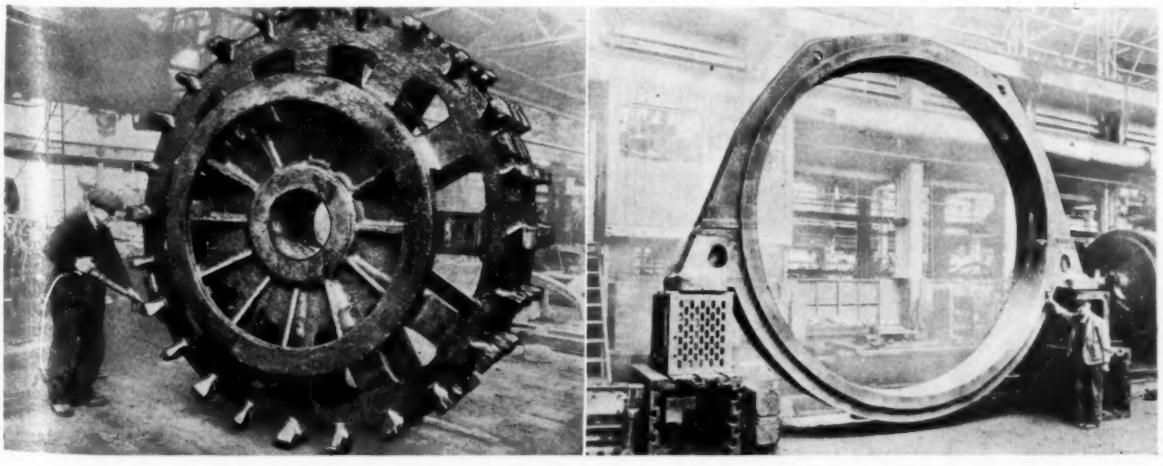
The steel-making plant itself consists of a battery of side-blown acid-lined convertors fed by cupolas adapted to the latest methods of control. It may be noted that the Bessemer-acid process is said to be particularly suited to the production of high-permeability steel, owing to the claim that a metal of very low carbon content is obtained more readily than by other methods. A typical permeability curve, plotted by the National Physical Laboratory, gives an indication of the standard quality of the steel supplied by this company.

At the time of a visit which we recently paid to the works extensive improvements had just been carried out with a



1. Small rotor spiders. 2. Electromagnet castings. 3. Frame heads for traction motors. 4. Stators for small special purpose electric motors

view to increasing the production capacity and to securing greater control at all stages of manufacture. The old cupolas have been replaced by new ones, giving an increased hourly output, and new shot-blasting plant, annealing ovens and cranes have been installed. In order to cope with the in-



Rotor and stator for 1,640-b.h.p. electric motor (English Electric Co.). They weigh, respectively, 6¼ and 14¼ tons

Meetings and Discussions

Some results of research into the effects of voltage surges in transformers were contained in a paper read before the I.E.E. last evening. At another I.E.E. gathering, the first informal meeting of the session, the President gave his views on his own subject—installation work. At last week's Coal Convention Dr. Bewley took an opportunity of mentioning electricity in agriculture. Sir Alexander Gibb, in his presidential address to the "Civils," called for better co-ordination of engineering activities. These and other papers and addresses are reviewed.

Transformer Surge Effects

THE effects of impulse voltages on transformer windings are discussed in the paper by Dr. T. E. Allibone and Messrs. D. B. McKenzie and F. R. Perry (of the Metropolitan-Vickers Electrical Co., Ltd.) that was read before the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 5th, illustrated by a cinematograph film and demonstration apparatus. The effects of single and multiple surges of varied wave shapes on single- and three-phase windings of differing characteristics have been investigated and, in general, good agreement has been obtained between theory and experiment. An attempt is made to correlate theory and practice in relation to a core-type transformer having a uniform winding insulation throughout, but the methods followed are applicable to any special design of transformer.

The theory of the transference of surges between windings is too involved for representative formula to be included in the paper, but the essential features are stated and, qualitatively, the following general statements have been verified by the authors' investigations.

Briefly, the transient appearing in the low-voltage winding due to the imposition of a rectangular wave on the high-voltage winding may be regarded as the sum of four components: (*a*) an electrostatic component, which depends on the capacitances from high-voltage to low-voltage winding, and low-voltage winding to the core; (*b*) an oscillatory component corresponding to the oscillations in the high-voltage winding; (*c*) an oscillatory component consisting of the free oscillations of the low-voltage winding; (*d*) an electromagnetic component consisting of a rise and fall of voltage dependent on the turn ratio of the transformer. Components (*b*) and (*c*) are of relative unimportance; (*a*) is not important when the low-voltage winding is connected to low impedances such as transmission lines and cables, but may become dangerously high when the low-voltage winding is open-circuited; (*d*) is capable of producing voltages in the low-voltage winding of crest value equal to the applied surge divided by the turn ratio, but, again, these values may be greatly exceeded when the low-voltage winding is open-circuited.

Since the effect of reinforced coils is being investigated by one of the authors for the E.R.A. it is merely stated that only if the increase in strength exceeds the increase in voltage appearing across the reinforced turns does reinforcement provide a solution of the problem of voltage concentration which is encountered.

From oscillographic records it has been deduced that the voltage across the first coil is reduced by 8 per cent. of the total applied voltage by the presence of a static end ring. A slight reduction also occurs in the amplitudes of the oscillations within the first coil. The beneficial effect of such a ring cannot be doubted when the ring is made of adequate proportions.

The present analytical study is claimed to have fully substantiated the authors' previous arguments advocating the use of a 1/50 wave for the impulse testing of transformers. They still consider it advisable to apply surges of both polarities in turn, synchronised with the 50-cycle voltage of polarity opposite to that of the applied impulse.

The testing of transformers is at present regarded as a type test, and tests on one phase should suffice. Excitation of one phase is, therefore, necessary and the other phases should be protected by gaps, or resistances (say, 600 ohms, simulating transmission lines). If the tests were made all at the same voltage there would be no appreciable difference between them, but whereas the V.D.E. and S.E.V. tests apply surges of approximately twice phase voltage to the windings, the impulse test as carried out in Great Britain and the U.S.A. applies surges of from 6 to 20 times the phase voltage. The latter are considered necessary because voltages of this order of magnitude can appear on transmission lines, and a test to twice phase voltage would appear to be valueless.

Steel Castings (*Concluded from preceding page*)

creasing demand for compressed air two additional Browett-Lindley compressors of 750 and 1,000 cu. ft. capacity have been put into operation.

Many of the castings from the K.L. steel foundry are finished machined before despatch. Bearing housings, for instance, are one example of this refinement. This work is carried out in adjoining shops, which have been enlarged to an area of nearly 100,000 sq. ft. and, like the foundry, extensively re-equipped. Among a great variety of machine tools we noticed in particular a lathe with independent variable-speed motors and taking work up to 8 ft. 6 in. diameter, which was specially built for rapid production.

The range of activity may be gauged from the fact that 1,200 workpeople are employed.

Impulse voltages in transformers
Improved installation work
Engineering co-ordination

Engineers and Empire Development

IN his presidential address to the INSTITUTION OF CIVIL ENGINEERS in London on November 3rd Sir Alexander Gibb explained how engineering, turning to practical account the discoveries of science, was the foundation of civilisation and of Empire building. Hydro-electricity had been one of the most powerful influences in Empire development, while telegraphy, telephony and radio were the principal channels of business communication.

Sir Alexander said he felt that there was a danger that the machine might take charge, and that perhaps the greatest problem that the engineer now had to face was the sane control of the forces of engineering, especially in transport. He anticipated that the day would come when something like unified control, at least on all questions of broad policy, of all means of transport would be in force.

The opportunities of the future were vastly greater than any that the past had offered, but he looked with some anxiety on the years to come. The machine sometimes seemed to be taking control; inventions and developments succeeded one another with bewildering speed, and there seemed to be no limit to the possible results of uncontrolled and misapplied ingenuity. In such circumstances no one could see where engineering might lead, or what limit there was to the power of the engineer. One thing was certain, however, and that was that there ought to be control.

Sir Alexander estimated that engineering provided, directly or indirectly, the livelihood of about one-seventh of the working population of Great Britain. Ever-increasing specialisation had inevitably resulted in engineering being split up into dozens of different categories and groups. He thought that if the great problems of the future were to be adequately dealt with it would be necessary to put a brake on that continuous disintegration, and that an attempt of some form or other should be made to co-ordinate and unite engineering activities in the broadest sense. It was necessary for everyone, individuals and institutions alike, to subordinate some of their more personal and independent views and feelings to a common policy. He hoped that the steps that the Institution of Civil Engineers was taking in that matter would lead to profitable results.

He would like it to be possible for one broad policy to inspire and guide all classes of engineers, and he hoped that in time there would arise a body of engineering opinion so weighty, so authoritative, so sure, so sane, that it would prevent waste of energy and misplaced enterprise, and would inevitably command attention in the politics, administration, and life of Great Britain and the Empire. He believed that that would be the greatest, and perhaps the only safeguard, for the future of civilisation.

Improving Installation Work

IN accordance with custom, the first informal meeting of the new session of the INSTITUTION OF ELECTRICAL ENGINEERS was opened by the president, Mr. H. T. Young, in London, on October 26th. His subject was the adequacy and safety of electrical installations, which, he said, were so closely connected as to be largely dependent on one another; an adequate installation was likely to be a safe installation.

Engineers in contact with consumers should use considerable caution and should not frighten people by the use of the word "danger." Consumers should be educated to use apparatus

with proper care, without being frightened. Electrical accidents were remarkably few.

Assisted-wiring schemes for the smallest domestic consumer had been carried out more completely and with greater safety in this country than in any other in the world. Most of the work had been done under the control of the supply undertakers by registered contractors, and nearly always in accordance with the I.E.E. Regulations.

Medium-class residential property, in which the speculative builder operated, was very much neglected, and it was necessary to continue the education of the general public on the advantages of electricity over other services. The speculative builder was probably the greatest hindrance to electrical development with the installation which he provided, although socially he was no doubt serving a useful purpose in housing development.

In larger buildings installations were often found to be inadequate before being put into use. It was necessary to plan installations concurrently with the planning of the building. Architects and the building industry in general really required engineers capable of co-ordinating all services. Flexibility was also necessary, for in certain office buildings 1,000 alterations to internal and Post Office telephones were made in a year to suit the changing conditions of businesses and staff.

Before compulsory registration, both of wiremen and contractors, could be adopted it would be necessary to draw up a set of regulations enforceable by statute. As a basis for discussion, it was suggested that a code might be formed covering the main essentials, such as the carrying capacities of cables, insulation, method of earthing, &c., which would cover all buildings, and which could be used in conjunction with a standard specification or code of practice for each system of wiring.

In conclusion, Mr. Young made suggestions for promoting safety. He would not permit socket outlets and portable apparatus in bathrooms. Encouragement should be given to methods of installation which would reduce the use of flexible cords, particularly with the heavier-current carrying apparatus. Where flexible cords were necessary they should be made up in standard lengths, properly reinforced at the ends, as there was no doubt that flexible cords and the connecting of cords to apparatus was the most unsatisfactory part of electrical installation. Manufacturers should provide a guarantee of insulating performance, by a mark, of all apparatus sold.

Activities in Ireland

THE prospect of a reduction in the price of electricity was referred to by Mr. Warren Storey in the course of his address as chairman of the Irish Centre of the INSTITUTION OF ELECTRICAL ENGINEERS in Dublin on October 29th. He paid a tribute to the work of Sir John Griffith and Mr. Laurence Kettle, with particular reference to the recently approved Liffey hydro-electric scheme. He stressed the advantages of this scheme to Dublin and its ever-increasing suburbs.

He reviewed the early history, objects and accomplishments of the Institution of Electrical Engineers, especially of the Dublin Centre, and spoke of the efforts that had been made, not only to protect and establish the status of the qualified engineer, but also to protect the public from unqualified persons. He stated that the work of the electrical engineer had altered and increased tremendously within recent years owing to scientific and industrial expansion.

The transactions of the Irish Centre revealed the wide scope of its contribution to the technical and industrial progress of the nation, such subjects as the production of power and heating from peat, hydro-electric power, the establishment of electro-chemical works in Ireland, the application of electric power for traction and other important subjects, had received thorough investigation. Mr. Storey referred to the application of electricity to railway traction, and said that it was receiving close attention as a matter of paramount importance to railway engineers.

While acknowledging the great work of the universities in the education and training of the electrical engineer, he appealed for closer co-operation between university education and works experience in the training of young engineers. He also suggested the exchange of visits between students of various countries.

The Coal Convention

THE second annual convention organised by the COAL UTILISATION COUNCIL was held in London on October 29th and 30th. The seven papers submitted for discussion were mostly concerned with what the industry is doing to meet consumers' requirements.

Mr. E. Brewis, president of the Coal Merchants' Federation of Great Britain, pointed out that of an output of 220 million tons from the collieries of this country, a little over 161 millions represented home consumption. Of this, 35 million tons was used for domestic purposes. The quantity delivered for domestic use in Greater London was approximately the same as before the war, but when the greater area and larger population were taken into consideration the average consumption per house had greatly diminished. The average household order had fallen from one ton to 9 cwt.

Mr. C. A. Carlow, president-elect of the Institution of Mining Engineers, described what the collieries were doing to meet the requirements of consumers, from whose point of view either dry cleaning or wet washing was, he said, capable of giving good results with regard to ash reduction. Coal preparation equipment at a modern colliery might cost between £60,000 and £90,000. Fear as to the sufficiency of a suitable supply of "smalls" for large users was being overcome by the introduction of coal breakers by the collieries.

Mr. J. Roberts outlined developments in the use of solid smokeless fuels, remarking that one satisfactory method of utilising breeze was the Nicol sandwich system of firing chain grate stokers, whereby coal and coke were fed in alternate layers on to the grate, as employed by the London Power Co. British generating stations used nearly a quarter of a million tons of breeze per annum. Anthracite duff was used in pul-

Members of the English Electric (Stafford Works) Engineering Society at Hams Hall power station, Birmingham. In the centre of the group, marked with crosses, are Messrs. G. P. Sutton, resident engineer, J. Rogers, general manager of the Stafford works, H. Stanier, hon. secretary of the Society, and F. H. Goodall, assistant resident engineer.

verised-fuel plant, as at the Tir John power station of the Swansea Corporation.

Dr. W. F. Bewley, director of the Experimental and Research Station, Cheshunt, dealt with solid fuel and its derivatives in relation to agriculture and horticulture. He classed electricity as a derivative of coal and enumerated many of the ways in which it was employed on arable, dairy and poultry farms, and in market gardening. The author considered that a transportable type of motor might possibly be used in the future for electric ploughing at a cost much below that of the steam plough or oil tractor. In the West Midlands some of the large fruit and mixed farms had installed small canning plants with electric motor drives. Refrigerators were essential to the bottled milk trade, and in this case Dr. Bewley considered the electric drive to be one of the cheapest forms of power, with the advantage of reducing operation and labour charges. In Lincolnshire a machine had been designed and manufactured for washing celery, the celery heads being slowly rotated past a jet of high-pressure water supplied by an electrically-driven pump.

Interesting particulars were given of crop drying by hot air and soil heating by hot water. The author considered that electric soil heating was successful but too costly except for small areas.

Power Station Security

THE opinion that there was still vast scope for further developments was expressed by Mr. D. Maxwell Buist, of the Central Electricity Board (North-Eastern Area) in his address as chairman of the North-Eastern Centre of the INSTITUTION OF ELECTRICAL ENGINEERS on October 26th at Newcastle-on-Tyne.

He said that the depletion of the world's supplies of coal and oil was making engineers all over the world more and more anxious to rationalise the business of power production in order to conserve the remaining supplies. To-day five times as much electricity was produced as fifteen years ago, while the consumption of coal was little more than twice as great. This, at present coal prices, was equal to a saving of £12,000,000 per annum to the country. Mr. Buist estimated that the output of electricity during the next fifteen years would be trebled and reach 55,000 million kWh, while the coal consumption at 24,000,000 tons would be less than doubled.

The resources of spare plant and site capacity released by the "grid" scheme were being used up and the engineer must look round for further sites for his power stations. He urged that there should be a limit to the capacity of plant concentrated on any one site, and he believed the time was not far distant when the Government would have to take a much greater concern in the security of power production in time of war.

Electrical Garage Service.—"If car valeting, why not electrical valeting?" asked Mr. T. G. Mundy in Birmingham on October 29th, when he addressed the INSTITUTE OF THE MOTOR TRADE (West Centre) on "Electrical Service in the Modern Garage." The time had come, he urged, when they should consider offering the motorist a maintenance electrical service which would help to keep his car running efficiently, and without breakdown on the electrical side. There were twelve tests, which, with modern equipment, need take no more than an hour, and with them, they could completely diagnose the condition of the valves, pistons, cylinders, ignition, carburettor and the electrical components.

The importance of electrical equipment on the modern motor car, not as a group of accessories, but as a fundamental part of the car, and the necessity for considering it on this basis, was stressed in a lecture by Mr. E. A. Watson (of Joseph Lucas, Ltd.), which was delivered before the BIRMINGHAM ELECTRIC CLUB on October 30th.

Miners' Lamp Research.—At a meeting of the MINING INSTITUTE OF SCOTLAND at Edinburgh on October 28th, a paper on "Illumination Contours for Miners Lamps and Underground Illumination Survey," by Professor W. H. McMillan and Mr. S. Holmes, was read by Professor McMillan. It was pointed out that the paper, to which were added numerous statistics and diagrams, recorded the results of part of a programme of mine lighting research being carried out under the auspices of the Safety in Mines Research Board.

Electrically-propelled Vessels

THE annual report of Lloyd's Register of Shipping states that the output of shipbuilding yards during the year ended June, 1936, was greater than it had been for the previous four years.

The Register makes special note of ships equipped with electric propulsion during the year. The conversion from steam to Diesel-electric drive of the double-ended passenger ferry boat *Bellubera*, owned by the Port Jackson & Manly Steamship Co., Ltd., of Sydney, N.S.W., has now been completed. The equipment, which comprises four Diesel engines and electric generators totalling 1,280 kW, was built in the United Kingdom under the inspection of the Society's surveyors, and was installed in the existing hull at Sydney, New South Wales.

Three additional tug-boats with Diesel-electric drive were placed on order during the year, the inspection during construction and test of the entire propelling machinery in each case having been entrusted to the Society. One of these, the tug *Sir Montagu*, comprises a single 420-b.h.p., 650-r.p.m. engine by Davey, Paxman & Co., Ltd., and electric propelling equipment by the General Electric Co., Ltd. She has been placed in operation on the Thames and is reported to be giving the owners, the Erith & Dartford Lighterage Co., very satisfactory service.

The *Duchess of Abercorn*, a combined tug, salvage vessel and tender for the Belfast Harbour Commissioners, with propelling machinery by Harland & Wolff, Ltd., has just been completed. In this case the machinery comprises a twin-screw two-engine equipment of 1,000 s.h.p., 160 r.p.m., each generator being rated at 410 kW, 550 r.p.m. The switching arrangements permit one of the generators to be used alternatively for operating a pump for fire-fighting purposes. The remaining tug—a duplicate of the *Framfield*—is now under construction, and will be fitted with propelling machinery by the English Electric Co., Ltd.

During the year another classed vessel was equipped with exhaust turbo-electric drive, namely, the s.s. *Eros* (5,888 tons gross), built for the Erin S.S. Co., Ltd., by Harland & Wolff, Ltd., with electric propelling equipment by the Metropolitan-Vickers Electrical Co., Ltd., the motor being rated at 1,820 s.h.p.

The Society's register book now includes forty-two turbo-electric vessels of 482,563 gross tons and fifty-seven Diesel-electric vessels of 122,010 gross tons, representing increases of 2,327 and 849 tons respectively on the previous year's figures.

The employment of electric welding as an alternative to riveting in those parts of a vessel not of primary structural importance continues to increase. Welding is being largely adopted in the construction of oil fuel bunkers in both passenger and cargo vessels, and in the case of insulated ships it has proved of considerable service in obtaining that measure of gas-tightness required by the modern system of refrigeration.

Two large oil-carrying vessels have been completed, and four others are under construction, in which the whole of the transverse and longitudinal bulkheads, including the attachment to the hull, are welded; in the latter vessels the whole of the structure, with the exception of the shell plating and strength deck, is welded. Tested and approved electrodes now number, 117, of which seventy have been approved as complying with the special requirements for use in parts of primary importance in the structure of a vessel.

Since the issue of the last report, opportunity has occurred of making an examination of the all-welded tanker *Moira*, of 1,560 tons gross. This vessel, built under the Society's survey in 1935 by Swan, Hunter, & Wigham Richardson, Ltd., for Dampkibsselskabet Marna A/S, is the largest electrically welded sea-going ship yet constructed. After a series of voyages across the North Atlantic, the vessel was found to be in satisfactory condition, no defects of any kind having developed.

A vessel designed for service on the Great Lakes and River St. Lawrence, the *Franquelin* (2,097 tons gross), completed in May last by the same builders, and owned by the Quebec & Ontario Transportation Co., Ltd., in which welding has been completely adopted, has been examined after arrival in Canada and found to be satisfactory. In addition, a number of smaller vessels, generally for restricted service, of all-welded construction have been classed by the Society.

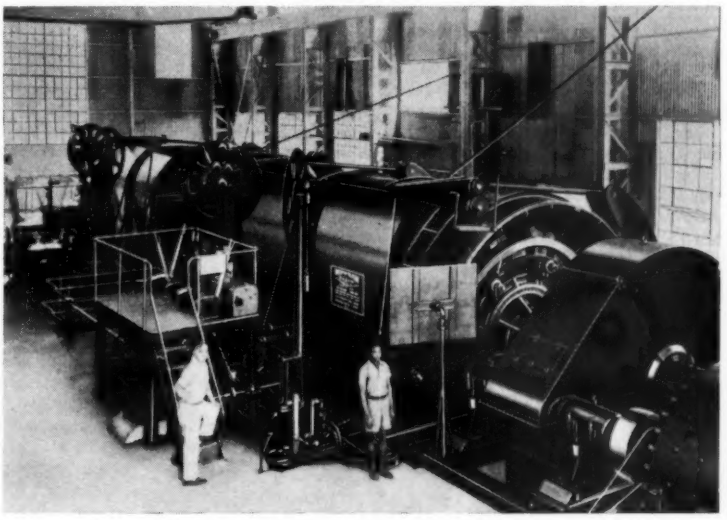
The Society's inspection of welding of engine structures and pressure vessels, both for marine and non-marine purposes, continues to increase. In addition, the demand for the Society's services for inspection duties in connection with all kinds of land machinery and installations is continually growing, and during the past year the surveyors carried out the inspection of large power stations, while in connection with the electrification of the Central Railways of Brazil, the inspection and testing of the traction motors and motor generators, gear wheels and pinions for the rolling stock has been entrusted to Lloyd's Register. The complete equipment will comprise 240 traction motors rated at 175 b.h.p., 1,350 V, 60 motor generators for train lighting, and 240 sets of gears and pinions.

Copper Mine Winding Plant

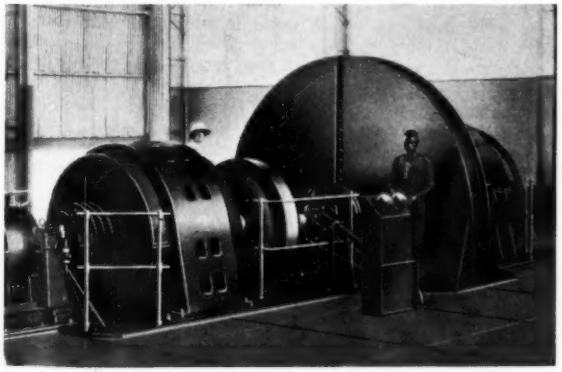
ELECTRIC winding plant completed this year for the Selkirk shaft of the Mufulira Copper Mines, Ltd., Northern Rhodesia, by the Metropolitan-Vickers Electrical Co., Ltd., includes Lilly overwind prevention devices, brake deceleration governors which make for longer life of the ropes, and motor-generator flywheel sets having synchronous induction motors and hydraulic coupling slip regulation devices for power factor correction.

There are two separate winders, one with double skips of the automatic tipping type for winding ore, and the other with one cage and a counterweight for winding men and materials. The plant also includes a separate motor-generator set (consisting of a 1,200-h.p. synchronous induction motor, a hydraulic coupling for slip regulation, an 11-ton flywheel, and a 1,120-kW d.c. generator) for each winder; and the necessary auxiliary gear. The ore winder is designed for an initial duty of raising ore in gross loads of 22,000 lb. from a depth of 1,000 ft.; the quantity of ore to be raised per day of 20 winding hours being 11,100 tons. The other winder has the same drum speed and is designed for a load of 136 men weighing 21,000 lb., upon which basis 2,230 men can be raised or lowered per hour from a landing stage 860 ft. below ground level. Both winders have been planned on the assumption that the second and third stages in the development of the mine will extend to depths below ground ultimately to 2,600 ft.

The main d.c. driving motors are rated at 1,600 (r.m.s.) h.p. (peak 3,200 h.p.) at 600 V and 290 r.p.m. They are of the open type, separately excited, compensated, and shunt wound. Each motor is connected by a Wellman-Bibby type flexible coupling to the pinion of a fine pitch double-helical single reduction gear of Metropolitan-Vickers manufacture. The gears now installed have a ratio of 8.9 to 1, giving a drum speed of 32.5 r.p.m., and a rope speed of 1,480 ft. per minute. When the intermediate stage is reached a second motor, duplicate of the existing one, will be installed on each winder with a larger pinion engaging with the diametrically opposite side of the gear wheel, reducing the gear ratio; and a similar pinion will then be fitted on the original motor, which is made capable of a 5 in. lateral movement to enable this to be done. The electrical parts of the two winders are exact duplicates and interchangeable throughout, so that one set of spares will suffice for both winders.



General view of the two winders



One of the two flywheel motor-generator sets

Each of the two flywheel motor-generator sets comprises a generator, an 11-ton flywheel, a hydraulic coupling slip regulator, and a synchronous induction motor with a direct-coupled exciter. The generators are rated at 1,120 kW, r.m.s. (2,240 kW peak) at 600 V and 750/640 r.p.m., and are of the open type, compensated, shunt wound, and separately excited. The synchronous induction motors are rated at 1,120 h.p. at 750 r.p.m. They are designed to give twice full load torque, and at normal rating take leading current at 0.9 power factor. The slip regulators were made by the Hydraulic Coupling and Engineering Co., Ltd., and form a variable speed connection between the generator and flywheel on one side and the motor on the other side. They allow the flywheel to fall in speed and relieve the power station of the peak loads, while the synchronous induction motors run continuously at constant speed and compensate for lagging current taken by other plant at the mine. Provision is made for each of the winders to be driven from either of the flywheel motor-generator sets, so that each set acts as a stand-by to the other.

When the second motors are added to the winders a second motor-generator flywheel set will be installed for each, and to ensure equal sharing of the load the two d.c. motors and generators for each winder will be connected in alternate series; an incidental advantage of this method of connection is that the potential of the d.c. system above earth is limited to that of one generator.

The mechanical parts of the winders were supplied by Vickers-Armstrongs, Ltd., the drums are double cylindrical and both are loose, driven through multi-tooth clutches which are engaged or disengaged by suitably interlocked oil operated clutch engines. For the man winder only one drum is fitted with a multi-tooth clutch, the other being fixed to the drum shaft.

In addition to hand-operated Ward-Leonard control gear, the ore winder is also designed for semi-automatic push-button control from each level, and for fully automatic control, the last mentioned being employed under normal running conditions from the beginning to the end of the shift without attention. The loading and emptying of the skips at the bottom and top respectively are also automatic, and are interlocked with the winder control. The man winder is fitted with hand-operated control gear for normal operation, but is also equipped with contactors for conversion to automatic operation.

The peak output of the winding motors exceeds 5,000 h.p., but the output of the synchronous induction motors does not exceed 2,650 h.p., the difference of 2,350 h.p. being made up by the flywheel.

Henley's Staff Dinner

THE attendance at Henley's staff dinner on Saturday last (Harrod's Georgian Restaurant) neared the five-hundred mark. Following the established commendable custom, the speeches were bright and brief. The toast of "The Henley Companies" was proposed by Mr. F. Anderson (cable sales manager), who, in the course of his remarks, claimed that the North Woolwich works had produced more rubber cables last year than any other British factory and probably more than any other in the world. Referring to the Gravesend works, he expressed the staff's regret at the retirement of Mr. R. O. Wright, the works manager, and extended a welcome to his successor, Mr. E. E. Judge. Mr. Anderson also spoke of the activities of the Tyre Company, the Holborn Construction Co., and the Henley Extrusion Machine Co. He thanked the directors for their decision that the staff should share in the prosperity of Henley's on the occasion of the forthcoming centenary. In responding, Mr. E. Lefeaux (manager of the North Woolwich Works) who occupied the chair, said that the cable company had been very busy and that, with the right direction, meant success. He mentioned the forthcoming celebration of the centenary of the first electrical work of W. T. Henley, and gave instances in which his fighting spirit was manifested. This spirit, though rather less physical in character, had descended to the present directorate. The chairman's health was proposed by Mr. R. O. Wright, who paid a tribute to Mr. Lefeaux's work for the company, first at Gravesend and later at North Woolwich. Mr. Lefeaux, in acknowledging the toast, recalled the days when he and Mr. Wright participated in cycling tours arranged by the late Sir George Sutton. After dinner the hall was cleared for dancing and there was an excellent cabaret show.

A New Phase Sequence Test.

By G. W. Stubbings, B.Sc., A.M.I.E.E.

IN the Varley test for the phase sequence of a three-phase supply the required indication is obtained by observing the relative brightnesses of two lamps connected, with a reactor or condenser, in star to the terminals of the supply. This test is elegant in theory and definite in indication, but the components required for it are not such as can be made up into a compact and portable testing equipment. Greater portability could be obtained by substituting two miniature voltmeters for the two lamps.

A slight modification of the Varley test enables an indication of phase sequence to be obtained by one voltmeter only and the components required for this modified test are a voltmeter, a non-inductive resistor of exactly equal ohmic value, and a condenser with an impedance numerically approximately equal to that of the voltmeter. As the voltmeter is merely required to indicate a rise or fall of voltage, it can be of the smallest and cheapest commercial pattern available. These components can be assembled to make up a very light and self-contained portable equipment for the testing of phase sequence.

In the diagram of connections of the test circuit (fig. 1) the voltmeter and the resistor are shown connected in series to two of the terminals of the three-phase supply. The condenser is connected to the third supply terminal, and it can momentarily be joined to the common connection of the voltmeter and the resistor by means of a push-button switch. When this switch is open the voltmeter will read one-half of the line voltage between the terminals of the supply connected to it and to the resistor. When the push-button switch

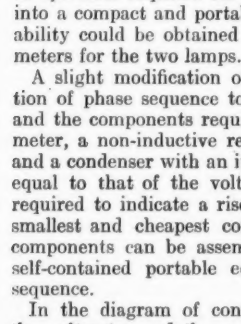


Fig. 1

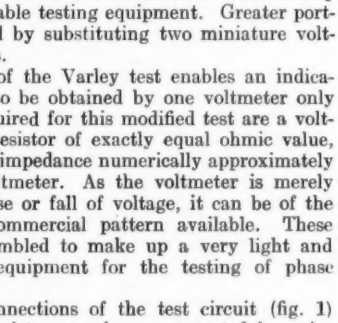


Fig. 2

is closed the voltmeter reading will increase if it is connected to the phase which leads that connected to the resistor, and vice versa.

By mounting the voltmeter between the two terminals of the non-inductive branches of the combination, the rule for the interpretation of the voltmeter indications can be very concisely stated in the following way: press the push-button switch and the voltmeter pointer will move towards the terminal connected to the leading phase.

The theory of this test is simple, and is a development of that used to explain the Varley test. In fig. 2 ABC is the triangle of the vectors of the line voltages; D is the mid point of AC. Upon BD a semi-circle is described. When the condenser is disconnected from the voltmeter the vector of the voltage on the instrument is DC. When the condenser is connected to the combination the locus of the point representing the potential of the star point is the semi-circle AOB, and the position of this point depends upon the ratio of the impedance of the condenser to that of the voltmeter and resistor. When this ratio is infinite the point O corresponds with D. When the ratio is zero and the condenser is short-circuited the point O moves to coincide with B. Assume a position of the star point potential represented by O. Then the vectors of the voltages on the resistor, the condenser, and the voltmeter are respectively OA, OB, and OC. For, as the resistor and the voltmeter branches are non-inductive, and of equal ohmic value, the vectors OA and OC also represent currents in these branches. OD is vectorially one half of the resultant of the resistor and voltmeter currents, and the reversed resultant, being the current in the condenser, leads the condenser voltage OB by 90 degrees, by the geometrical construction.

If the values of the impedance of the resistor and the voltmeter be assumed to be each 1 ohm, then OA, OC, and OD represent currents to the same scale as voltages. The condenser impedance will then be $OB/2OD=\frac{1}{2}\cot\theta$. Thus, the position of the point O on the semi-circle is fixed by the consideration that $\tan\theta=1/2n$ where n is the radio of the impedance of the condenser to that of the equal impedances of the voltmeter and the resistor.

It is evident from the geometry of the diagram that, excepting for the extreme cases in which the ratio is zero and infinite, the connection of the condenser to the voltmeter and the resistor will always increase the voltmeter reading if the instrument is connected to the leading phase, and will decrease this reading if the instrument is connected to the lagging phase. It also appears from an inspection of the diagram that whereas the voltmeter reading can increase to twice its value with the push-button switch open, the maximum possible diminution of the reading is only to something like one-half. As it is desirable that the indications of the test be as definite as possible, the investigation of the ratio of the condenser to the reactor impedances which gives the smallest possible reading of the voltmeter is a matter of practical interest.

When the vector triangle of line voltages is equilateral, the investigation of this condition is a matter of very simple geometry. The smallest value of the voltage OA occurs when this vector produced passes through the centre of the semi-circle P. Assuming that the value of the voltage on the voltmeter with the switch open is unity, the diameter of the semi-circle is $\sqrt{3}$. Calling this minimum voltage V we have, as AD has a magnitude of unity and is tangent to the semi-circle, $v(\sqrt{3}+v)=1$, and $v^2+\sqrt{3}v-1=\frac{1}{4}$. Whence $v=\frac{1}{2}(\sqrt{1}-\sqrt{3})$. The minimum value of the voltage indicated by the voltmeter is therefore approximately 0.46 of that which it indicated with the test switch open.

The value of the ratio n required to obtain this critical voltage is easily arrived at. The tangent of the angle APD is evidently $2/\sqrt{3}$, and this angle is equal to twice the angle θ. From the usual trigonometrical formula for the tangent of half an angle is therefore immediately obtained: $\tan\theta=\frac{1}{2}(\sqrt{7}-\sqrt{3})$, and since $\tan\theta=1/2n$ then $n=1/(2\tan\theta)$.

The ratio of the condenser impedance to that of the voltmeter should therefore be 1.09 to obtain the minimum reading when the instrument is connected to the lagging phase. The required condition is therefore obtained to a sufficiently close approximation if the impedances of the resistor, condenser, and voltmeter are equal.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

A Dangerous Arrangement

A manufacturer of heating apparatus is putting on the market an excellent type of immersion heater, and the effort has been well supported by supply engineers, but on approaching the large stores it has been found to be impossible to do business with them unless the heater is supplied with a two-core flexible and adaptor, in which case large orders could be placed. This attitude has been confirmed by two of the largest concerns in London, and I think reflects a very serious position.

These immersion heaters are largely used in conjunction with an electric cooker. Should any fault develop on the heater, the cook will inevitably be in a position to receive a fatal shock between the heater and the earthed cooker frame.

I understand the manufacturer in question has absolutely refused to supply the stores under these conditions, but in so doing he has the annoying experience of seeing other and inferior makes being sold in quantities in preference to his own.

I am wondering if a test case could not be brought to see who, if anyone, is liable in the case of sale of this dangerous apparatus.

H. MARRYAT.

London, E.C.1, *November 3rd.*

Fuse Renewals

I was extremely surprised to notice in your "Situations Vacant" coloumn an advertisement reading as follows:—"Required, youth for renewing fuses on consumers' premises, one able to drive a motor vehicle preferred." It was inserted on behalf of a supply authority.

I hope I am not correct in supposing that the main qualifications for this job are merely ability to repair fuses and drive a motor vehicle. Is this a "safety first" move to benefit the consumer?

H. W. ONGLEY.

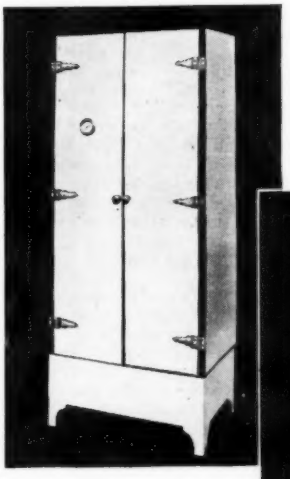
Winchester, *November 2nd.*

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Dish-washers and Drying Cabinets

Pumps have been eliminated in the new "Little Friend" dish-washers manufactured by NEWMECTRIC, LTD., 108, Victoria Street, London, S.W.1, the cleansing action being effected by means of a forced draught of hot air injected into the water so as to create strong jets impinging directly on to the table-ware. The hot air, which is produced by means of a vacuum-cleaner type motor (200 W) fitted with a small element (½ kW in the domestic machines and 1 kW in the commercial), besides maintaining the water at the desired temperature, serves to dry the crockery.



Three domestic models are made. The D 2 is 32 in. high, 22 in. wide and 15 in. deep, and can be supplied with a clothes-drying attachment. The D 3 is twice as wide, having two compartments, one of which can be used for rinsing alternately. Of particular use for blocks of flats, &c., a portable model, P 1, converts an ordinary sink temporarily into an electric dish-washer, the fan motor being installed above. The commercial model, C 4, has three compartments and its dimensions are: Height, 32 in.; width, 63 in.; and dept, 14 in.

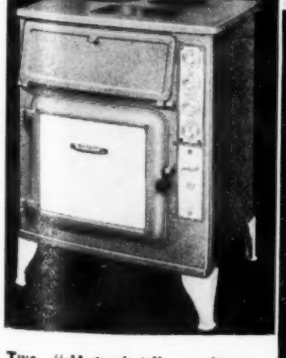
A forced draught of hot air is also used in two new drying cabinets. Model 1 has a loading of approximately 1 kW and is 5 ft. 10 in. high, 2 ft. 6 in. wide and 1 ft. 6 in. deep. Model 2 has a loading of 1½ kW and is 4 ft. 8 in. wide, the other measurements being approximately the same. Like the dish-washers, they are finished in white vitreous enamel, picked out with black, and have chromium-plated fittings.

Four-heat Plates for Hotpoint Cookers

A solution to the simmering problem is to be found in three new cookers produced by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street, London, W.1. As an alternative to the standard 8-in. diameter, 1,600-W "Torribar" plate a similar four-heat plate can be fitted which, on account of its comparatively low heat content, will give a simmering heat almost immediately after being switched from "full on."

If desired, a 1,850-W "Torribar" grill can also be provided as an alternative to the standard open-type grill. A non-electric kettle of the same size as the coils is supplied in order that the heat which must rise when grilling may be utilised for heating water and thus avoid waste of energy.

The convolutions of the element of the "Torribar" radiant boiling plate are so arranged that with the switch in the "medium" position a small inner plate is formed which is at full heat, enabling small utensils to be used economically.



Two "Hotpoint" cookers, Nos. 8012 and the 5011, and a view of the four-heat "Torribar" boiling plate

On all three models the electrical parts, thermometers and switches are interchangeable. The interiors are of the removable type with side and bottom elements, and the side plates can be easily unscrewed to expose all the wiring and fuses. Model 5011 is suitable for three to six persons, 6042 for four to seven, and 8012 for five to eight, the respective oven loadings being 1,750 W, 2,100 W and 2,800 W.

Installing Conduit-outlet Boxes

For facilitating the installation of conduit-outlet boxes in floors where they have to be put in in advance of tubing, the "Floor Core" has been introduced. The main features of the core, which is of cast iron, are: its conical shape for easy removal; a wood screw projecting from the bottom face (smaller diameter end) to enable the core to be inserted into the shuttering boards; a cupped bottom face; a tommy-bar handle used for carrying and also as a lever for screwing the core hard home on the top of the box, as a wrench to ease the core if it sticks due to excess of cement wash and a protective covering for the wood screw in transit; there are also two pins at the top of the "Floor Core" provided for wrenching purposes.

Top left: "Little Friend No. 1" drying cabinet and (below) P1 and D2 dish-washers

When the cores are in use a small hole is drilled in the centre of the outlet box through which the point of the wood screw is passed before being screwed into the wooden shuttering in the position previously marked out. The core is then screwed down until the cupped face presses firmly on the box and holds it in position. A small lip of the box stands out enabling the latter to be firmly gripped after the pouring of the concrete, the box remaining in the desired position when the floor is set. The core can be easily freed for installing the tubing, when it leaves an even conical hole. It is claimed that the saving in time compared with the method of using balanced loose wooden blocks is considerable. These cores are made by the AUTOMATIC EQUIPMENT MANUFACTURING CO., 81a, Kirkwood Road, S.E.15.

An Air Thermostat

For regulating the temperature of rooms warmed by electric tubular or panel heaters air thermostats are widely used. In addition to the well-known round type of thermostat made and sold by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, a rectangular type of pleasing appearance has now been produced by the same company. This thermostat, like its predecessor, is suitable for controlling heater circuits up to 15 A, 250 V, a.c., or 0.1 A, 250 V, d.c., and it can be used for larger loads in conjunction with contactors. It can be set to operate at any desired temperature within its range, which extends from 45 deg. F. up to 75 deg F. a suitable overlap between opening and closing ensuring that operation is not too frequent. The movement is of the q.m. and b.

The G.E.C. thermostat

The rectangular thermostat was specially designed to meet the requirements of the architect of the new London University buildings. The cover and base are made of moulded insulating material, either brown or cream as desired. A conduit box is supplied, drilled at top, bottom and both sides, and the terminals (which are provided with sweating sockets) project through the back of the thermostat into this box so that they are easily accessible. The thermostat is fitted with an internal adjusting screw sealed by means of an insulating cap which is screwed into the cover.

The thermostat can also be supplied with a self-contained switch, which enables it to be cut out of action when heating is not required; there is thus no necessity for separate tumbler or other switches in the circuit, and the cost of installation is correspondingly reduced.

An Improved Steriliser

Improvements in the "Rosamon" steriliser are announced by the WHITE ELECTRICAL INSTRUMENT CO., LTD., 10, Amwell Street, Rosebery Avenue, London, E.C.1. A new safety immersion heater provides that, should the steriliser boil dry a plunger switch operates, cutting off the supply. It is reset by means of a press-button at one side. Other improvements include the fitting of more robust hinges and lever handle and a larger capacity draining tap. It is stated that the fitting of the immersion heater type of element has increased the efficiency of the apparatus by 20 per cent.

The "Rosamon" steriliser

Electric Fires

Among recently introduced new fires are the "Radiant" (No. 394) and "Corporal" (No. 356) of H. G. MOSELEY & CO., LTD., Eddo Works, Hospital Street, Birmingham. The "Radiant" is made in 1- and 2-kW sizes, and, with a chromium reflector and surround, can be obtained in black, pastel, blue and green shades. The other model has a 750-W element.

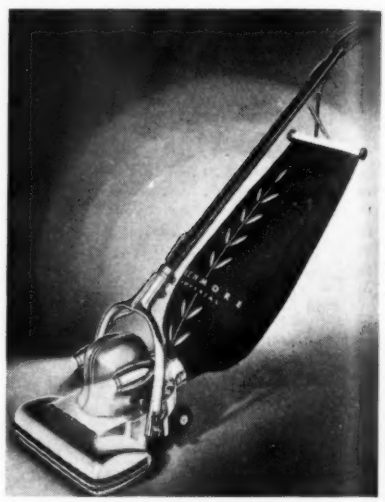
There are also several new "Efesca Surves" fires by FALK, STADELMANN & CO., LTD., 83-93, Farringdon Road, London, E.C.1; among them are the 1-kW "Sunray O," in oxidised silver with a chromium reflector and the "Wizard," a small low-priced sheet-steel radiant fire available with 1- or 2-kW elements.

Unusual construction characterises the "Windsor" fire made by the LIMIT ENGINEERING CO., LTD., 15-29, Windsor Street, London, N.1. Even heat reflection over an angle of 120 deg. from the centre of the element in a horizontal plane is claimed by virtue of the curved parabolic reflector and curved element. Direct radiation over 180 deg. is claimed. Oxidised silver or copper is the usual finish and d.p. kick switches are fitted. One- or two-bar fires are available with loadings of 1¼ and 2¾ kW respectively.

Another speciality is the Morphy-Richards safety fire (MORPHY-RICHARDS, LTD., St. Mary Cray, Kent). The "Junior" model (600 or 750 W) is especially interesting. While it is fitted with a pedestal for normal use, a special wall bracket can be obtained. This bracket is fixed permanently to the wall and the fire can be slipped on to it in a few seconds. Porcelain terminal blocks and cable junctions are provided and asbestos insulated connecting wire. The "Senior" model which we illustrate is loaded at 1 kW.

Vacuum Cleaner Improvements

By twisting the handle grip of the new "Kenmore Imperial" vacuum cleaner the brush and suction nozzle are accurately adjusted to suit different depths of pile, without stopping the cleaner or stooping. Apart from convenience, this feature is claimed to save a considerable amount of wear on carpets. Furthermore, an automatic indicator on the side of the cleaner shows the correct adjustment for all conditions.



The "Kenmore Imperial" cleaner

Ball-bearing wheels on a swivel are designed to keep the mouth of the cleaner flush with the rug surface, even if one wheel is off the edge of the carpet, while twin headlights (controlled by a separate switch) are particularly useful when cleaning under large pieces of furniture and in dark corners.

The motor used is about ½ h.p., and the beating, sweeping and suction mechanism is all rubber mounted, the ball bearings being self-lubricating. The dust bag closes automatically on being removed and is easily emptied. In spite of being of exceptionally robust construction and having a nozzle over 12 in. wide the cleaner is remarkably light and easy to manipulate. A three-core flex is provided and the usual attachments are available.

Of similar design, though without all the refinements of the above model, the "Kenmore Standard" is a stoutly built machine selling at just over half the price. Both machines carry a year's guarantee and they are marketed in this country by SEARSINT, LTD., Thames House, 1, Millbank, S.W.1.

Some newcomers in electric fires: 1. "Corporal"; 2. "Radiant"; 3. Morphy-Richards; 4. "Sunray O"; 5. "Windsor"; 6. "Wizard I."

United States Electrical Exports

January-June recovery

DURING the first half of this year there was a recovery of 20 per cent., compared with the corresponding period of 1935, in American exports of electrical machinery and apparatus, the total value being $43,470,000. From the accompanying figures, which have been taken from recently issued official returns, it will be seen that the recovery extended to nearly every group except generators, while there were noteworthy increases in transformers and converting plant. Marked progress is shown in the exports of domestic appliances, but in the radio group the rate of advance slackened.

	Jan.–June 1936 $ (000).	Inc. or dec. $ (000).
Generators, d.c.	146	+ 114
Generators, a.c.—		
Under 2,000 kVA	115	— 60
2,000 kVA and over	87	— 131
Steam turbine generator sets	107	— 69
Accessories and parts for generators	390	+ 198
Arc welding sets	368	+ 155
Self-contained lighting units	241	+ 130
Storage batteries, 6 and 12	557	+ 17
Other storage batteries	261	— 1
No. 6 dry cell batteries	100	— 24
Flashlight batteries	1,053	+ 81
Radio B and C batteries (dry)	241	+ 78
Other dry and wet cell primary batteries	69	+ 27
Power transformers, over 500 kVA	249	+ 109
Distribution transformers, 500 kVA and less	179	— 18
Instrument transformers	96	+ 21
Other transformers	146	+ 42
Battery chargers, non-rotating	56	+ 36
Double-current and motor generators, dynamotors, synchronous and other converters	272	+ 167
Switchboard panels, except telephone	158	+ 32
Power switches and circuit breakers over 10 A.	608	+ 208
Fuses	67	+ 10
Watt-hour and other measuring meters	225	+ 23
Electrical indicating instruments	238	— 3
Electrical recording instruments	107	— 28
Other electrical testing apparatus	470	+ 174
Lightning arrestors, choke coils, reactors and parts	238	— 31
Motors, ¼ h.p. and under	300	+ 60
Motors, over ¼ and under 1 h.p.	105	— 8
Stationary motors, 1–200 h.p.	695	+ 202
Stationary motors, over 200 h.p.	80	— 23
Railway motors	14	— 21
Electric locomotives, mining and industrial	218	+ 51
Station and warehouse electric motor trucks	75	+ 3
Starting and controlling equipment for industrial motors	533	+ 128
Starting and controlling equipment for electric railway and vehicle motors	117	+ 32
Portable electric tools	453	+ 19
Accessories and parts for motors	800	+ 194
Household electric refrigerators	6,336	+ 1,741
Commercial electric refrigerators up to 1 ton	1,111	— 27
Parts for electric refrigerators	2,908	+ 798
Flashlight cases	316	— 20
Electric fans	293	+ 90
Bulbs for automobiles, flashlights and Christmas trees	177	+ 5
Other metal filament bulbs	395	+ 3
Other electric lamp bulbs	79	+ 34
Searchlights and airport beacons	10	— 2
Floodlights	112	+ 60
Electric household washing machines	446	+ 212
Electric household washing machine parts	26	*
Electric domestic vacuum cleaners	257	+ 146
Electric domestic vacuum cleaner parts	140	*
Other domestic motor-driven devices except tools	298	+ 108
Electric flat-irons	108	+ 24
Electric cooking ranges	176	+ 70
Other domestic heating and cooking devices	260	+ 82
Industrial electric furnaces, ovens and other heating devices	282	+ 116
Therapeutic and X-ray apparatus	709	+ 108
Radio transmitting sets, tubes and parts	898	+ 13
Receiving sets	6,875	— 45
Radio receiving tubes	1,661	+ 293
Receiving set components	2,435	+ 402
Loudspeakers	286	+ 60
Other receiving set accessories	244	— 3
Telegraph apparatus	111	+ 10
Telephone instruments	100	— 58
Other telephone equipment	943	+ 289
Bells, buzzers and alarms	94	+ 17
Starting, lighting and ignition equipment	687	+ 20
Insulating material	167	+ 29
Metal conduit, outlet and switch boxes	270	— 7
Sockets, outlets, fuse blocks and lighting switches	353	— 91
Electric interior lighting fixtures	457	+ 154
Electric exterior lighting fixtures	85	+ 9
Other wiring supplies and line material	329	— 47
Other electrical apparatus	2,747	+ 401
Insulated iron or steel wire and cable	13	+ 8
Rubber-covered copper wire	550	+ 170
Weatherproof copper wire	100	— 33
Telephone cable	27	+ 7
Other insulated copper wire	466	+ 125

* Comparable figures for 1935 not available.

New Books

Mercury Arcs. By F. J. TEAGO and J. F. GILL. Pp. 104; figs. 49. London: Methuen & Co. Price 3s. net.

This book is one of a monograph series on physical subjects to enable those who are no longer in contact with active scientific work to keep abreast of modern research and development. The only criticism we can really make is that the volumes are so small that the scope of the subject and the author's presentation of it is necessarily cramped. Nevertheless, they are among those that give the best value for money in technical literature, and the present work forms a welcome addition to, and well maintains the standard of the series.

There are twelve chapters, which cover constructional details, grid control of voltage and current, voltage regulation, current-voltage characteristics, rectification, inversion and regeneration, wave-form analysis, transformer rating, power factor, and the mathematics of the mercury arc. The basis of the book was a series of lectures given in a design course in the Department of Electrical Engineering in the University of Liverpool and briefly outlines the more important aspects of mercury-arc rectification. The principles are treated mathematically, though very simply, and should form an excellent preliminary to a deeper study.

A more comprehensive bibliography might well have been given. Reference is made to only half a dozen books when at least two dozen more readily spring to one's mind. Probably the most interesting paragraph is an original contribution on page 10 on the controversial question regarding the cause of pernicious firings of the arc, usually termed "arc back." The chapter on wave-form analysis was found to be all too brief, for this subject deserves a work to itself. This little book can be recommended to all who are interested in its subject.

Principles of Electric and Magnetic Measurements. By P. VIGOUREUX and C. E. WEBB. Pp. 392; figs. London: Blackie & Son, Ltd. Price 20s.

This work is divided into two distinct sections. The first, on electrical measurements, is by Mr. P. Vigoureux, and the second, dealing with magnetic measurements, is by Mr. C. E. Webb. The work is described as a text-book of experimental electricity and magnetism for honours students, and this description very satisfactorily indicates its scope and also the viewpoint of the authors in writing it. The treatment is generally of an academic character. The theoretical proofs are formal in character and concise in expression, and require a mathematical knowledge well up to graduate standard for easy reading. A fair amount of space is devoted to description and explanation of commercial measuring instruments and supply meters, but the treatment generally lacks penetration. As the book has been written mainly for students of physics, the authors have not dealt with any of the practical problems connected with three-phase measurements. An omission of this kind limits the utility of the work as a manual of reference for testing engineers.

The outstanding sections in the first part are those dealing with electrostatic measurements, with measurements at radio frequencies, and with electric charges. Other noteworthy chapters are those on electrolytic and bridge measurements. The second part, on magnetic measurements, covers the usual ground, and, in addition, contains some interesting sections on magnetostriction.

The work can be highly commended as a comprehensive and authoritative study of the science of electrical measurements. Of its value to the class of student for which it has been written there is no question, and as a work of reference for the practical engineer it will be of considerable utility.

The Technology of Plastics. By H. W. ROWELL. Pp. 206; figs. 44. London: Plastics Press, Ltd. 10s.

This book aims at providing the essential technical particulars of the properties of moulded plastics available and of how they are manufactured. No attempt has been made to cover uses that are only in the experimental stage, but, with a view to making the work useful to students, chapters on such subjects as heat transfer and plasticity are included. The suitability of electricity for the heating of platens and moulds is discussed in relation to other methods in use, and there is a chapter on estimating costs. The work should be of value to those requiring an introductory manual on the composition and properties of commercial plastic materials and the plant and technique required in moulding them.

Proceedings of the International Telephone Consultative Committee. Tenth Plenary Meeting held in Budapest, September 3rd-10th, 1934. English Edition. Pp. 660; illustrated. London: Bernard C. Holding, Ltd. Price 25s.

The Comité Consultatif International Téléphonique was founded in 1924 as a consultative organisation by the leading telephonically developed countries of the world, which are now represented by thirty-eight telephone administrative bodies The Committee meets annually and the proceedings are recorded officially in French. As in past years, an "unofficial" English translation has been prepared by the technical staff of the International Standard Electric Corporation and the present volume contains the five volumes which are printed separately in the French edition.

The first of them deals first with the formal business of the meeting and enumerates the questions submitted for study. The precautions to be taken when working in manholes on underground cables are stated and finally a bibliography is given of over 1,000 English, French and German papers, etc., on telephone engineering and allied subjects.

The three parts of the second volume give the Committee's recommendations in regard to the protection of telephone lines against magnetic and electric interference, electrolytic corrosion and chemical corrosion.

Volume 3 relates to definitions in telephone transmission and to recommendations on the following:—Principles relating to telephone transmission; general rules concerning the make-up of transmission systems; subscribers' installations, local lines

and central telephone exchanges; repeater stations; international lines; the operation of telephone and telegraph circuits in the same cable; and the co-ordination of radio telephony and telephone systems. This volume concludes with various specifications recommended by the C.C.I.F.

Transmission forms the subject of Volume IV, being discussed under the headings of standards of transmission, testing methods, measuring apparatus, and the maintenance and supervision of lines and installations.

The final volume is concerned with the organisation of the C.C.I.F. and with the operation of international telephone systems and tariffs in the form of the Committee's recommendations.

This book should be regarded as indispensable to every telephone and telegraph engineer, for together with the earlier Proceedings it forms a veritable compendium of communication circuit engineering. It is well printed and produced and contains a most comprehensive index.

Electrical Laboratory Experiments. By V. KARAPETOFF. Arranged and revised by B. C. DENNISON. Pp. 487; figs. 332. London: Chapman & Hall, Ltd. Price 20s.

This book is a single-volume abridgment of Karapetoff's well-known two-volume "Experimental Electrical Engineering." The selection and arrangement of the experiments have been carried out by Professor Dennison, who revised the fourth edition of the two-volume work. The wide scope of Karapetoff's work is an indication of the usefulness of the present volume. The treatment is essentially from an engineering standpoint, and the inclusion of a wider choice of experiments on fundamental electrical measurements would have been acceptable.

The major portion of the book is concerned with tests on electrical machinery. It is in this that the book excels. The explanatory theory is good and the graphs are clear, as is well shown in the section on "Separation of Losses." The experimental instructions are given in a rather general way, and, in some cases, they would hardly be adequate without assistance to enable the book to be used as a laboratory instruction manual. Some experimental directions suggest that they should be given to students with due caution—*e.g.*, on page 228 the student is advised to throw off a belt at high speed!

The use of certain symbols and terms may sound strange to a British user, but this is common to many American technical books. A useful section on current and voltage relations in polyphase circuits is included.

Sections on electrical illumination, photometry, photo-cells, rectifiers (other than mercury-arc), thermionic tubes, electrical pyrometry, internal resistance of cells, and instrument-transformer calibrations are among those that might have been thought of sufficient interest to warrant some mention, but they are not dealt with in this abridgment.

This book can be recommended as a serious effort to produce a laboratory manual which yet contains sufficient theory to enable the student to perform experiments intelligently.

Testing Radio Sets. By J. H. REYNER. (Third edition.) Pp. 239; figs. 115. London: Chapman & Hall, Ltd. Price 10s. 6d. net.

This is an enlarged and revised edition of a book which was first published six years ago, and, due to the rapid development of broadcast receivers, its size has been increased by a third. The first half of the book deals with the systematic tracking down of faults in receivers and the second half with the testing of receivers in the laboratory and factory. Much of the first part has been rewritten since the last edition to bring it into line with the latest developments in receivers, and the second part has been enlarged.

There is no doubt that a systematic method of tracing faults is the best method, and the author sets out to show how this can be done intelligently with simple apparatus. Each part of the circuit of modern receiving apparatus, from source to loud speaker, is dealt with in turn in a reasoned statement which is clear and practical. In the second part, tests in the design stage and later in the assembled stage are fully and simply explained.

Methodical testing of receivers at all stages has become the rule, rather than the exception, during the last few years, and this enlarged edition of a very useful book will be welcomed by those engaged in constructing new sets and those engaged in servicing sets already in use.

Shorter Notices

"The Road to Success." Edited by Margaret I. Cole. Pp. 271. London: Methuen & Co. Price 7s. 6d. net.—This is a volume of twenty essays by women upon the choice of a career for members of their sex. It covers a wide field, ranging from medicine to landscape gardening. From the electrical point of view the principal contribution is that of Miss Caroline Haslett, C.B.E., who writes on engineering and electrical housecraft. Miss Haslett tells of the circumstances which led her to take up engineering and, later, to organise the Electrical Association for Women, the objects of which she outlines as a preliminary to showing the scope which the electrical industry offers to women.

"Beitrag zur Berechnung von Mastfundamenten," by H. Fröhlich. Pp. 81; figs 65. Berlin: Verlag von Wilhelm Ernst & Sohn. Price: Rm.6.65.

"Statistical Year Book of the World Power Conference—No. 1, 1933 and 1934." Edited by F. Brown. Pp. 111. London: World Power Conference. Price: 20s.

"Electronic and Electron Tubes," by E. D. McArthur. Pp. 173; figs. 89. Price 12s. 6d. net. "Handbook of Engineering Fundamentals." Edited by O. W. Eshbach. Illustrated. Price 25s. net. "Control of Electric Motors," by Paisley B. Harwood. Pp. 390; figs. 188. Price 22s. 6d. net. London: Chapman & Hall, Ltd.

"Television—A Guide for the Amateur," by S. A. Moseley and H. McKay. Pp. 144; figs. 50. London: Oxford University Press. Price: 5s. net.

"A Text Book of Illumination," by W. Kunerth. (Second edition.) Pp. 276; figs. 112. Price 15s. net. London: Chapman & Hall, Ltd.

"Heaviside's Operational Calculus," by E. J. Berg. (Second edition.) Pp. 258; figs. London: McGraw Hill Publishing Co. Price: 18s.

"The Nation's Water Supply," by R. C. S. Walters. Pp. 244; figs. 74. London: Ivor Nicholson & Watson, Ltd. Price 31s. 6d.

"Television," by E. J. G. Lewis. Pp. 95; figs. 13. Price 5s. "How to Buy Timber," by R. R. Rivers. Pp. 121; figs. Price 3s. 6d. London: Sir Isaac Pitman & Sons, Ltd.

"Wireless Engineering," by L. S. Palmer. Pp. 544; figs. 307. London: Longmans, Green & Co. Price 21s.

"Technical Electricity," by H. T. Davidge and R. W. Hutchinson. (Fifth edition.) Pp. 520; figs. 393. London: University Tutorial Press. Price 12s. 6d.

In the Courts

Film Actress's Claim for Damages

On October 29th, in the King's Bench Division, Mr. Justice Porter reserved judgment, after a hearing lasting several days, in an action brought by Mrs. Florence Russell (professionally known as Peggy Crawford) against Criterion Film Productions, Ltd., and Mr. Gunther Kampf. The plaintiff claimed damages for personal injuries which she alleged she sustained during the filming of "The Amateur Gentleman."

Mr. Kampf was stated to be in control of the lighting of the "set" which Mrs. Russell maintained was so negligently applied that she became temporarily blind, her eyesight being impaired, and her shoulders injured.

The defendants denied liability, stating that the lighting was normal for a film studio. Alternatively they pleaded that the possibility of ill-effects of lighting on certain persons was well known, and the plaintiff had voluntarily accepted the risk. She could have stopped work and prevented injury to herself and was therefore guilty of contributory negligence.

One of the witnesses called by the plaintiff was Sir Duncan Watson, who said that for floor illumination 5-kW lamps were used instead of the more usual 2-kW size. Prolonged exposure to the rays of these was harmful.

Evidence was also given by Mr. Robert Linderman, managing director of a company making studio lights. He said that he could not imagine anyone familiar with film work not being aware of the risk of going near the lights or looking into them, although a newcomer might be ignorant of the risk. He had never known of injury to anybody when the lamps were screened.

Counsel for the defence submitted that he had no case to answer. The plaintiff was aware of the possible danger and had exaggerated her condition. If there had been negligence it was obviously that of servants of the company, and as the plaintiff was also a servant of the company the doctrine of "common employment" applied.

Counsel for Mr. Kampf submitted that the plaintiff had no cause of action against him. In evidence Mr. Kampf said he was a camera man of sixteen years' experience. The chief electrician was in charge of the working of the lights.

As stated, judgment was reserved at the conclusion of the arguments.

Damages for Wrongful Dismissal

The Court of Appeal, consisting of Lords Justices Greer, Slesser and Scott, on October 27th heard the case of Salt *v.* the Power Plant Co., Ltd., on the appeal of the plaintiff from the judgment of Mr. Justice Horridge in the King's Bench Division in favour of the defendant company.

The plaintiff, Mr. Robert Chas. Salt, brought the action to recover damages for his wrongful dismissal from the position of secretary of the defendant company. Mr. Schiller, K.C., for Mr. Salt, said he became secretary in 1918 at a salary of £400 a year, later increased to £500. In 1925 the managing director of the company wrote a letter to Mr. Salt confirming an agreement that his employment should continue for a further three years, at the end of which period the company could terminate the agreement by giving Mr. Salt notice to that effect prior to the ensuing December 31st, and in the absence of such notice the engagement should remain in force as a permanent one. Mr. Salt continued for a further nine

years, but in June, 1935, the company gave him six months' notice terminating his engagement in December, 1935. Mr. Schiller contended that according to the agreement notice had to be given by a certain date, and that that date had long passed, and therefore that Mr. Salt's engagement could not be terminated.

Mr. G. Blanco White, K.C., for the company, submitted that "permanent" merely meant that Mr. Salt's employment was expected to continue and not that it was to continue to the end of his life. He contended that the engagement of Mr. Salt could be terminated at the conclusion of three years by six months' notice ending on December 31st in any year.

At the conclusion of the arguments the Court allowed the appeal. Lord Justice Greer, in giving judgment, after stating the facts, said he was clearly of opinion that the right of the defendant company to give Mr. Salt notice terminating his engagement had long expired, and that the notice given by the company was a bad notice. Mr. Justice Horridge was wrong in his construction of the letter written to Mr. Salt by the managing director of the company. He (the Lord Justice) was of opinion that Mr. Salt had an engagement for life, subject to performing his duties satisfactorily. In his opinion the appeal should be allowed with costs, and there would be an order for a new trial unless the parties agreed to a reference to a referee to assess the damages. The other members of the Court concurred.

On November 2nd the Lords Justices were informed that the parties had agreed that the case should be referred to an Official Referee for the purpose of assessing the damages to be paid to Mr. Salt.

Imprisonment for Former Secretary

At Dumbarton on October 28th James Lothian was charged with the embezzlement of sums amounting to £422 which he had received on behalf of M. & C. Switchgear, Ltd., while employed as secretary and treasurer of that company. There was a second charge which was not proceeded with. It was stated by the prosecution that the accused man held the position mentioned from June, 1931, until March last, when a new secretary was appointed. The latter, after sending out what appeared to be outstanding accounts, received letters informing him that the accounts had been paid. Upon investigation it was found that the moneys had been appropriated by Lothian, who now pleaded guilty to embezzling a total of £250.

Sheriff Black imposed a sentence of six months' imprisonment.

A Works Canteen at Coventry

The number of employés at the Coventry telephone and radio works of the General Electric Co., Ltd., has been doubled during the last three years and the existing accommodation at the works canteen became insufficient. Considerable extensions have therefore been carried out, and at the same time a complete re-equipment has been effected, giving an improved service and menu. Mr. M. J. Railing, vice-chairman and joint managing director of the G.E.C., accompanied by Mrs. Railing, recently visited Coventry to inspect the canteen. It is on two floors and is operated on the cafeteria or self-service system. There are two buffets and a kitchen service counter. All cooking is done in the kitchen on the ground floor and supplies are taken to the buffets by an automatic conveyor system. Full trays are loaded on to an elevator and automatically transferred to the main conveyor, which extends right across the building to the far side, where sub-conveyors lead to the ground floor buffet or the first floor as required. Used plates and crockery from the first floor are returned by way of an "Express" passenger lift. Stainless steel service counter equipment is used throughout, and steam-heated hotplates and hot cupboards enable the food to be served hot to the customer and plates and dishes to be kept warm. About 500 complete lunches are provided daily, and the organisation works so efficiently that upwards of 3,000 people are served during the first ten minutes of the lunch hour. The kitchen itself is equipped with the most modern and complete range of G.E.C. electric cooking apparatus, including roasting ovens, grillers, fish fryers, boiling-table, vegetable boilers, stockpot and pastry oven. Two double roasting ovens of the compartment type are used for the cooking of all meat joints, and a cabinet roaster is provided for extra large joints, poultry, &c. A large griller mounted on a stand deals with steaks and chops, while an adjacent boiling table, having six pairs of hotplates and two individual plates, provides for sauces, custards and general boiling operations. Two cylindrical vegetable boilers and a stockpot for soups and gravies are provided and incorporate "Magnet" quick-boiling hotplates. Fish and chipped potatoes are handled by two fish-fryers, while another large cooking unit is a single deck oven for baking pastry, cakes, buns, and so on. All the main cooking equipment is finished in grey vitreous enamel and stainless steel. Further, the kitchen is equipped with electric toasters, egg poachers and boilers; steam-heated carving tables and steaming ovens; and electrically driven labour-saving devices, including a Hobart cream whipper, a dough and cake mixer (with whisking and mincing attachments), and an ice-cream mixer and freezer. Tea and coffee making are done by automatic apparatus, and a soda-fountain equipment with an automatic electric carbonator is also provided. An electric griller and an electric warming cupboard are installed in the first-floor buffet. All crockery and glass washing is handled by means of a Hobart dish-washer, and a hot water supply for the sinks is provided by an electric water heater at each buffet. The total loading of the electrical equipment is about 150 kW. The general illumination of the canteen is carried out by dispersive reflectors on the ground floor and totally enclosed units on the first floor.

The canteen at the G.E.C. Coventry works showing (top) Mr. and Mrs. M. J. Railing during their visit, with Sir William Noble (director) and Messrs. H. P. Wells (general manager of the Coventry Works), A. R. Kahl (chief engineer), and R. E. Robinson (sales manager); (left), the first-floor buffet; (right), the kitchen

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The Brewers' Exhibition

At the Brewers' Exhibition now being held at the Royal Agricultural Hall, Islington, London, electrical interest centres to a very large extent on refrigeration equipment, a dozen or so manufacturers having displays. A room cooler in a handsome wooden cabinet is shown for the first time by Kelvinator, Ltd., who are also featuring a special bar cabinet for draught and bottled beers and a model beer cellar with a forced convection cooling unit operating in conjunction with refrigerating apparatus. Among its representative display of equipment the International Refrigerator Co., Ltd., has specimens of "Coldrator" compressors, bottle coolers and cabinets, while in addition to their "Hallmark" cellar cooling plant, bottle cooling shelves and cabinets, J. & E. Hall, Ltd., show an automatically refrigerated yeast storage cabinet. Other types of refrigeration equipment are to be seen on the stands of L. Sterne & Co., Ltd.; Liverpool Refrigeration Co., Ltd.; York Shipley, Ltd.; Lightfoot Refrigeration Co., Ltd.; British Automatic Refrigerators, Ltd.; Asco Refrigeration, Ltd.; and A. J. Balcombe. Beside its "Coldspot" refrigerators, Searsint, Ltd., is showing its latest types of "Kenmore" domestic vacuum cleaners and washing machines, while the exhibit of Utilities (London), Ltd., includes "Servel" air-conditioning units and refrigerators, "Thermozon" winter air-conditioning and heating plant, and "Vent-Axia" air extractors. The larger ice-cream making plant is to be found on the stands of many of the companies already mentioned, but a small type of electric freezer, the "Reliance," is shown by Condrup, Ltd. Demonstrations of "Thor" vacuum cleaners, washers and ironers are given by the Hurley Machine Co. (England), Ltd. The "Centrifilter" (G. J. Worssam & Son, Ltd.), for filtering chilled beers, embodies entirely new methods, and an automatic continuous pasteuriser is shown for the first time by G. Hopkins & Sons, Ltd. The "Bratby" beer stabilising plants (Bratby & Hinchliffe, Ltd.), have a capacity of twenty barrels an hour and are fitted with automatic electric control. Bottle washers, fillers, cappers and labellers, almost without exception electrically operated, continue to show improvements in design, and new apparatus includes cask and case cleaning machines. Mechanical stokers are shown by Mechanical Coal Stokers, Ltd. ("Redi") and Combustions, Ltd. ("Thermokol"), conveyors and conveyor equipment of various types being included among the exhibits of W. & C. Pantin, Ltd.; Hugh Campbell; and the Renold & Coventry Chain Co., Ltd. Both the Drayton Regulator & Instrument Co,, Ltd., and Negretti & Zambra are specialists in all scientific instruments required by brewers and maltsters, such as regulators, recorders and indicators. Electric signs particularly suitable for hotels and inns appear on the stands of Caspar, Ltd.; Cinescope Publicity Co., Ltd.; Press & General Publicity Service, Ltd.; and Youngsigns, Ltd. The exhibition closes this evening (Friday).

"I'm Electric" Club for Young People

The autumn number of *Electrical Housekeeping* (E.D.A. 1352) contains details in the Children's Corner of the formation of an "I'm Electric" Club. An imposing membership certificate and badge are being issued and if the scheme meets with a reasonable response it should prove valuable as a means of interesting the coming generation in electrical methods, and at the same time securing the immediate interest of parents. The Electrical Development Association tells us that the idea is being explored somewhat experimentally at first, but it is hoped shortly to suggest that the various supply showrooms throughout the country should become local headquarters for the Club.

Irish Free State Electrical Imports

September proved another active month as regards the imports of electrical machinery and cognate material into the Irish Free State, a total of £109,953 being attained as compared with £93,627 in September, 1935. The appended table gives details of the imports during the nine months ended with September last as compared with the corresponding period of the preceding year, an increase of £33,884 being shown. Eight of the items increased and four decreased.

	JAN.–SEPT. 1935. £	1936. £
Electric motors	35,586	38,717
Other electrical machinery	154,437	167,195
Dry batteries and parts	22,098	14,366
Electric lamp bulbs	52,700	39,787
Electric lighting accessories, fittings and parts	60,261	60,267
Electric wires and cables, insulated	72,902	77,756
Telephone and telegraph apparatus	5,278	13,249
Radio receivers, complete	68,490	64,350
Radio-gramophones, complete	3,313	1,816
Other radio apparatus, fully or partly assembled	4,306	5,817
Radio parts and accessories	52,641	64,059
Other electrical goods and apparatus	189,796	208,313
Totals	£721,808	£755,692

Electricity at a Brighton Exhibition

The accompanying illustration shows the stand of the Brighton Corporation electricity undertaking at the recent Brighton and Hove Ideal Home Exhibition held in the Dome and Corn Exchange, Brighton, from October 5th to 17th. The exhibition was organised by Southern Exhibition Services, Ltd., of Brighton. The undertaking's stand was devoted particularly to exhibiting the appliances which are offered on hire and to stressing the idea of electrical service. A water supply was not available but a 1½-gall. heater was shown "in action" by means of a circulating pump. A small amount of cooking was kept going although owing to lack of space demonstrations were not practicable. Another feature which attracted interest was a glass kettle. Coloured lighting, controlled by a flasher within the pedestal, was effective when the bubbles were rising. An obvious point, but one that could be missed, is that distilled water should be used to keep the kettle clear.

The display of the Brighton Electricity Department at the recent local Ideal Home Exhibition

"Lewcos" Dramatics

The Lewcos Dramatic Society is presenting "The Man From Toronto," a comedy in three acts by Douglas Murray, at the Guildhall School of Music and Drama, London, E.C.4, on Tuesday, November 10th, at 8 p.m.

The Contractors' Year Book

The latest edition, for 1936-37, of the "Electrical Contractors' Year Book" shows further expansion and now comprises 639 pages, including advertisements. It varies little from its immediate predecessor, except, of course, that it has been brought up to date. The usual lists of members (alphabetical and geographical) are given, again there are tables of supply systems, and the other useful features of past issues are retained. We notice one important change: the section headed "E.C.A. Trading Policy" has given place to "The Fair Trading Policy," for during the past year the latter code has been put into operation by the electrical industry. The Year Book sets it out in full and reproduces the various schedules.

Another, smaller, addition is a definition of the word "shop" as used in the working rules. This has been agreed by the N.J.I.C. for the Electrical Contracting Industry to cover branch establishments (for the purpose of calculating the payment of fares and travelling time). The Year Book is obtainable from the Electrical Contractors' Association, 23, Bedford Square, London, W.C.1, at 5s. net or 5s. 6d. post free.

The Motor Cycle Show

The outstanding electrical development at the Motor Cycle Show at Olympia, which closes to-morrow, is the introduction and widespread use of automatic voltage control for battery charging by H. Miller and Joseph Lucas. There is a demonstration of this at the Lucas stand showing how the battery cannot be overcharged and how light may be obtained from the dynamo in the event of the battery being low. This development may tend to bring coil ignition into favour as it has done with cars, especially in conjunction with special anti-vibration battery suspension such as Lucas are showing, but at present only 17.4 per cent. of the machines have coil ignition, as compared with 21.6 per cent. in 1935. On the Lucas stand there is also a very effective demonstration of the new Lucas foglamp. In addition, all kinds of lamps, horns, switches, &c., are displayed on the Miller, Lucas and Bosch stands, while ammeters, voltmeters, &c., are shown by the Cooper Stewart Engineering Co., Ltd., and S. Smith & Sons, (Motor Accessories), Ltd. Other exhibitors are the East London Rubber Co. and Brown Bros., Ltd. The "Anglepoise" lamp is shown on the Terry stand, while there is a comprehensive display of enamels on the stand of Pinchin, Johnson & Co., Ltd.

Orders Recently Booked

In order to cope with the continually increasing demands for electricity, the Yorkshire Electric Power Co. is making large extensions to its Ferrybridge power station. It has just awarded a contract to the English Electric Co. for two 40,000-kW steam turbo-alternator sets running at 3,000 r.p.m. These machines are the first of this output and speed to be ordered for use in this country.

The contract for the heating installation in connection with the Worksop Central Library and Museum has been placed with Rosser & Russell, Ltd., of Leeds. The scheme includes panel warming in the ceilings throughout and is supplemented by floor panels in the reading room. The boiler house plant, comprising a 200-kW, 400-V electrode circulator and equipment, is being supplied by Bastian & Allen, Ltd. The electricity supply is from the Worksop Corporation Electricity Department (chief electrical engineer, Mr. M. S. Mason).

Hick, Hargreaves & Co., Ltd., have received an order for a 50,000-kW surface condensing plant with auxiliaries and closed feed system in connection with the extensions to the Ironbridge generating station of the West Midlands Joint Electricity Authority. This is the third 50,000-kW condensing plant supplied by the company to Ironbridge.

A Birmingham Exhibition

At the Homes and Fashion Exhibition which was held in Bingley Hall, Birmingham, from October 13th to 24th, the Birmingham Corporation Electric Supply Department had a comprehensive display. The exhibits included a selection of electric lighting fittings, cooking and water-heating apparatus,

The Birmingham Electric Supply Department's display at the local Homes and Fashion Exhibition

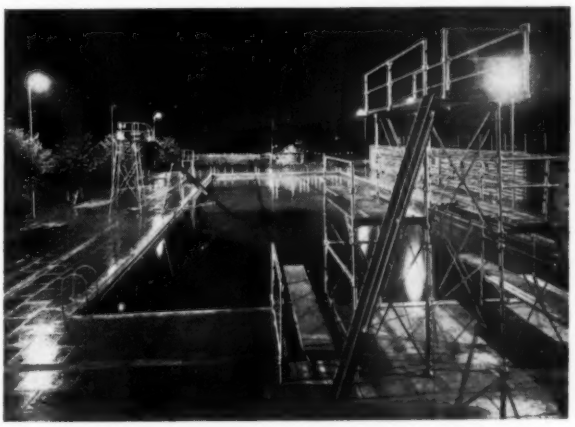
wash-boilers, washing machines, refrigerators, vacuum cleaners, fires and other domestic labour-saving appliances. The stand attracted a good deal of attention, and served a good purpose in spreading the "electrical idea" amongst householders in Birmingham and the surrounding districts.

Electrical Wholesalers' Dinner

The annual dinner of the Electrical Wholesalers' Federation is to be held on Thursday, March 4th, 1937, at the Savoy Hotel.

The Hampton Court Swimming Pool

One of the latest open-air swimming pools has recently been completed at Hampton Court, a short distance from the Palace. The pool, which has been constructed for Storedems, Ltd., is known as the Upper Deck Swimming Pool, and is 133 ft. in length by 50 ft. wide. The even illumination is obtained by means of nine type L.S. 120 Ediswan "Waltham" lanterns fitted with "Royal Ediswan" 1,000-W lamps. The lanterns, of which there are five one side of the bath and four on the other, are mounted on 28 ft. poles. Iron standards equipped with Ediswan "Sphera" pole top units



The Upper Deck Swimming Pool, Hampton Court

have been erected for the purpose of lighting the car park and entrance. The lighting equipment was supplied by the Edison Swan Electric Co., Ltd., and installed by W. S. Patching & Son, of Molesey.

The Batti-Wallahs' Society

The next luncheon of the Batti-Wallahs' Society will be held on November 18th at the Hotel Victoria, London, when an address will be given by Mr. H. Hobson, of the Central Electricity Board.

Sound Films for Electrical Demonstrations

The Fulham Electricity Committee has had under consideration the question of purchasing a sound-film equipment for use at electricity demonstrations in the showrooms and elsewhere. The borough electrical engineer has inspected various kinds of apparatus and has advised that a model costing £135, plus £5 15s. for a stand, appears to be the most suitable for the Council's purposes. The Committee is of opinion that the apparatus suggested would be of very considerable value in attracting business, and recommends the proposed purchase.

Trade Announcement

A. J. Shrosbery & Co., Ltd., electrical and mechanical engineers, of 69, Crouch Street, Colchester, have opened a branch depot at 2, Market Place, Old Road, Clacton-on-Sea.

L.M.S. Railway Electrification Contracts

The L.M.S. Railway announces that in connection with the electrification of the Wirral lines from Birkenhead Park to West Kirby and New Brighton further important orders for sub-station and track equipment and for power transmission lines have been placed. According to the *Financial Times* these are as follows:—For sub-station equipment: Hewittic Electric Co., Ltd. (glass bulb rectifiers); Crompton, Parkinson, Ltd. (e.h.v. switchgear); British Thomson-Houston Co., Ltd. (d.c. switchgear); Automatic Telephone & Electric Co., Ltd. (remote control apparatus); J. L. Eve Construction Co., Ltd. (power transmission lines). For track equipment: Lancashire Steel Corporation, Ltd. (conductor rails); Bullers, Ltd. (conductor rail insulators); British Insulated Cables, Ltd. (conductor rail and running rail bonds).

The American Electrical Industry

According to statements made at a recent meeting of the National Electrical Manufacturers' Association in Cincinnati, the American electrical manufacturing industry has shown considerable recovery during the past year or two. It is estimated that the current year's business will be 25 per cent. in excess of that of 1935, while anticipation looks for a further 30 per cent. increase next year. Price conditions have recently been more stable and the main business has been in power station, industrial and distribution equipment. There is expected to be an improvement in the transmission and distribution equipment sections very shortly.

The F.B.I. Business Forecast

The "Business Forecast" published in the F.B.I. "Business Barometer" for the fourth quarter of 1936 states that the traditional signs of a boom are beginning to appear. Unemployment outside the distressed areas has fallen to a level at which there is a shortage of certain types of labour. Wholesale commodity prices also have been rising and conditions are favourable to a continuation of the movement. Apart from the prospect of some slowing down in building activity, there is nothing to indicate the onset of a set-back in the near future. On the contrary, the chief problem in the coming months, apart from the "special" unemployment of the distressed areas, is likely to be how to keep in check the growth of purely speculative developments and inflationary tendencies. Export trade for the first time for many months is showing a tendency to expand, but it is too early to

judge how far the movement is likely to go. The devaluation by the former gold bloc countries must be regarded as a disturbing feature in this respect, unless it is followed by an inflationary movement under the leadership of the U.S.A., after the presidential election.

A Church Lighting Installation

The new Congregational Church at Meads Lane, Seven Kings, is of special interest on account of the modern built-in type of lighting. The architect required a lighting system which would harmonise with the clean modern design of the building. After several trials, Holophane built-in "Hedralite" fittings were specified. In the nave there are eight large

The Meads Lane Congregational Church, Seven Kings, illuminated by means of Holophane "Hedralite" fittings

single-plate fittings, each equipped with a 150-W lamp, with eight slightly smaller units using 100-W in the aisles. The architect was Mr. P. W. Meredith, 34, Old Queen Street, Westminster, W.1. The accompanying illustration shows the church interior at night.

The Birmingham Civic Centre

The consent of the Ministry of Health has been received by the Birmingham Corporation to the installation of electric thermal storage heating at the first block of buildings to be erected at the city's new Civic Centre.

The installation, which will be of 1,500-kW capacity, will be the largest of its kind in the Midlands. The boiler plant will consist of electro-boilers, operating at a pressure of 11,000 V, electricity being supplied during the night hours. The heat so produced will be stored in a number of thermal storage cylinders and will be circulated through the heating system at predetermined temperatures to maintain the required warmth in the building. The heating system will be by low pressure hot water, employing panel heating in the ceilings and walls, and in conjunction with this heating plenum ventilation, mostly of the unbalanced type, will be employed, including air washing and conditioning plant. The new building, which will cost about £300,000 and will house six departments of the Corporation service, will be one of the architectural features of the City.

Japanese Electric Lamp Exports

The exports of electric lamps and parts from Japan during the first half of the current year attained a value, taking the yen at the old rate of 2s., of £801,600 as compared with £705,900 in the corresponding six months of 1935.

French Electrical Imports and Exports

French imports and exports of electrical machinery, apparatus and goods during the six months ended with June last, as compared with the corresponding period of 1935, are shown in the appended tables. The values are given in thousands of francs, while for purposes of comparison the sterling value of the total, converted at the new approximate rate of 105 fr. to the £, is also given. It will be seen that the half-year's imports show a decline of £232,760 and exports a drop of £183,515.

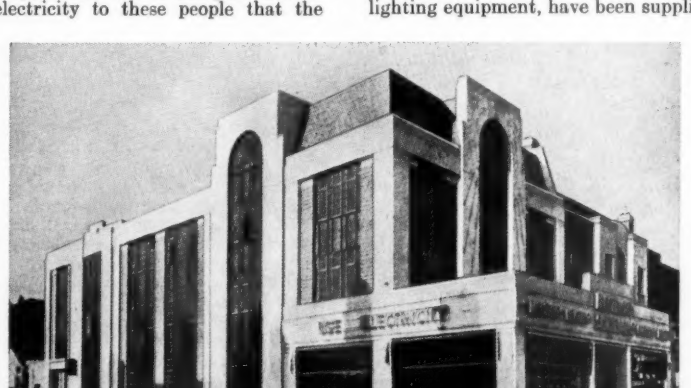
	Imports. Jan.–June.		Exports. Jan.–June.	
	1935. 1,000 fr.	1936. 1,000 fr.	1935. 1,000 fr.	1936. 1,000 fr.
Dynamo-electric machines, transformers and parts	18,217	14,709	13,162	9,80
Telephone, telegraphic and other electrical appliances	66,119	52,876	49,438	34,13
Incandescent lamps and radio valves	19,458	16,959	6,927	6,87
Arc lamps and parts	54	81	41	1
Carbons for electrical and industrial purposes	3,215	2,701	6,882	6,41
Electric wires and cables ...	2,244	2,983	12,177	12,15
Parts of electrical apparatus ...	9,142	8,531	5,312	5,64
Magnets, other than electro ...	214	299	5,466	4,44
Accumulators and parts	786	738	1,194	1,06
Dry and wet batteries, condensers and parts	10,136	5,422	—	—
Porcelain and other insulators ...	809	749	3,303	4,09
Total fr.	130,394,000	106,048,000	103,902,000	84,633,00
Total at 105 fr. to £	£1,241,848	£1,009,088	£989,543	£806,02

Islington's New Showrooms

AFTER negotiations lasting eleven years Islington at last possesses municipal showrooms and offices, a £25,000 building at the corner of Holloway Road and Camden Road having been opened last Saturday by the Mayor, Councillor H. G. Coleman.

Welcoming the Mayor, Councillor G. T. Dickinson, chairman of the Electricity and Lighting Committee, said the local undertaking had for many years been a very prosperous one, the number of its consumers increasing at the rate of nearly five thousand a year. There were still, however, many who regarded electricity as a luxury, and it was to bring the advantages and cheapness of electricity to these people that the showrooms had been established. It was hoped, too, that the showrooms would enable the working woman to realise that electricity was the supreme labour-saver in the home and was one of the greatest and cheapest benefits ever offered to her. He thanked the Electricity and Lighting Committee, the borough electrical engineer (Mr. A. P. MacAlister) and his staff and others, for their work in connection with the showroom.

Congratulating the undertaking on its enterprise, Sir John Brooke, vice-chairman of the Electricity Commissioners, said that the occasion marked a change of function as well as policy of the undertaking, for it had now passed the stage when its energies were directed solely to the supply of electricity. It now had three duties: To provide electricity at a reasonable tariff, to enable the housewife to buy the apparatus necessary, and to tell her how to use it. The undertaking had a very big field before it since only 41 per cent. of the families in its area used electricity, but he was confident that with the facilities available it would go right ahead.



Islington Electricity Department's new showrooms in Holloway Road

The new building (which will not be in full operation until November 23rd) has three floors providing, in addition to the showrooms and demonstration rooms, accommodation for the whole of the technical and clerical staff, thus freeing the Eden Grove offices for the storage and reconditioning of apparatus. Every facility has been made available for the attractive display of apparatus and Holophane colour-changing equipment has been provided for the showroom windows. The showroom and demonstration fittings, as well as the office lighting equipment, have been supplied by Falk, Stadelmann & Co., Ltd.; Davis Bros., Harcourt & Co., Ltd., and Sun Elecl. Co., Ltd. Siemens automatic telephones link up all parts of the building.

The electricity supply for the showrooms is stepped down from 2,000 to 200 V by two 200-kV.A. Hackbridge transformers, the E.C.C. high-voltage switchgear being provided with protective relays supplied by Nalder Bros. & Thompson. The low-voltage metal-clad switchboard was made by the English Electric Co., Ltd. For emergency lighting there is a "Keepalite" system, while the thermal storage heating system, installed by G. N. Haden & Sons, Ltd., comprises a 2,500-gal. boiler fitted with four 50-kW Reyrolle elements and Brookhirst Switchgear contactors. There are Heatrae water heaters in the lavatories, and other electrical equipment installed includes clocks (Gillett & Johnson, Ltd.), lifts (Marryat & Scott, Ltd.), and exterior signs (Brilliant Neon, Ltd.).

New Bridport Showrooms

New showrooms for the Bridport Corporation electricity undertaking were opened this week by the Mayor, Alderman A. R. Travers. Alderman E. S. Reynolds, chairman of the Electricity Committee, referring to the progress of the undertaking, mentioned that the area of supply had been extended to Beaminster, Bradpole, Chideock, Whitchurch, and Charmouth. Soon they were hoping to extend to Loders.

The Belgrade Radio Exhibition

The products of a number of British manufacturers were exhibited at the recent Radio Exhibition held at Belgrade, Yugoslavia, and among the exhibitors were Belgrade Lloyd,

The stand of Belgrade Lloyd (Agents for the G.E.C.) at the Belgrade Radio Exhibition

the agents of the General Electric Co., Ltd., of England. British-made receivers are very popular in this extensive area of Central Europe and, as our picture shows, the stand was an excellent advertisement for British products.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price. November 4th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3½d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£194	£6 inc.
Grade II... ... ... ,,	£135	£4 inc.
Grade III ... ... ,,	£72	£2 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	8 d.	¼d. inc.
c ,, Tubes (solid drawn) ... ... ,,	10½d.	¼d. to ½d. inc.
c ,, Wire, basis ... ... ,,	8½d.	¼d. inc.
c Copper Tubes (solid-drawn)... ... ,,	11¼d.	½d. inc.
g ,, Bars (best selected)... ... per ton	£76	£2 inc.
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£47 10s.	£1 10s. inc.
d ,, ,, Wire Rods ... ,,	£53 10s.	£1 10s. inc.
d ,, ,, H.C. Wire ... per lb.	8 5/8 d.	⅛d. inc.
f Ebonite Rod ... ... ,,	1/6 to 2/- plus	—
f ,, Sheet ... ... ,,	1/3 to 1/6 10%	—
a German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	10½d.	¼d. inc.
i Iron, Pig (Cleveland, No. 3) ... per ton	67/6	—
i ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£22	£1 10s. inc.
g Mercury ... ... per bot.	£14 2s. 6d.	5s. inc.
e Mica (in original cases) small ... per lb.	9d. to 1/6	—
e ,, ,, ,, medium ... ,,	5/- to 10/-	—
e ,, ,, ,, large ... ,,	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	1/-	—
p ,, ,, rolled strip & sheet ,,	11¾d.	—
p ,, ,, wire ... ... ,,	1/0½d.	¼d. inc.
o Platinum ... ... per oz.	£9 15s.	£1 dec.
d Silicium Bronze Wire ... ... per lb.	8 ⅜d.	⅜d. inc.
g Spelter ... ... per ton	£16 13s.	£1 13s. inc.
r Steel, Magnet, in bars ... ... per lb.	7¾d.	—
g Tin, Block (English) ... ... per ton	£212	£12 10s. inc.
n ,, Wire, Nos. 1 to 16 ... per lb.	3/8	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

New Catalogues and Lists

Westinghouse Electric International Co., 2, Norfolk Street, London, W.C.2.—A leaflet illustrating small electrical appliances such as toasters, irons, &c., suitable as Christmas gifts.

L. G. Hawkins & Co., Ltd., 30/35, Drury Lane, Kingsway, London, W.C.2.—A catalogue of "Universal" domestic appliances, including irons, kitchen and cooking equipment.

Holmes-Wedgwood Shades, 63, Queen Victoria Street, London, E.C.4.—A catalogue of "Cashlight" and other desk standards, reflectors and fittings formerly marketed by Cash, Whitehurst & Co. and now being handled by this company.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—A revised price-list of semi-enclosed and cartridge fuses.

Engineering & Lighting Equipment Co., Ltd., Sphere Works, St. Albans.—A pamphlet giving details of fittings for electric-discharge lamps.

Renown Electric, Ltd., 524, Radford Road, Nottingham.—A catalogue of new "Dorchester" and "Sherwood" lighting fittings.

Clayton's, King's Lane, Bishopton, Stratford-on-Avon.—Details of a battery oiler.

Harcourts, Ltd., 21a, Newman Street, London, W.1.—A leaflet describing a self-centring anti-vibratory lampholder.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—A booklet illustrating the wide variety of special applications for which Pirelli-General wires and cables are designed.

Falk, Stadelmann & Co., Ltd., 83/93, Farringdon Road, London, E.C.1.—A catalogue of table lamps, floor standards and shades, &c.

Goodliffe Electric Supplies, Ltd., 8, Eagle Street, High Holborn, London, W.C.1.—A folder containing new pamphlets dealing with tongs, clamps, central cone terminals, and other wiring accessories, and the "Triometer."

Lincoln Electric Co., Ltd., Broadwater Road, Welwyn Garden City.—A technical booklet dealing with arc-welding equipment.

W. Sanders & Co., Ltd., Falcon Electrical Works, Wednesbury.—Catalogue of switches and sockets, &c.

Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2.—A 68-page catalogue of electric fires and heaters.

Lowne Electric Clock & Appliances Co., Ltd., Boone Street, Lee, London, S.E.13.—Leaflets illustrating a new range of synchronous electric clocks.

Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1.—A catalogue of valves and batteries.

Bankruptcy Proceedings

M. Franks, 4, Bayford Road, Littlehampton, lately Arcade Road, Littlehampton, electrical and radio engineer.—The receiving order herein was made on a creditor's petition recently, and according to the statement of affairs filed there are ranking liabilities of £1,243 and assets of £366, leaving a deficiency of £877. Debtor attributes his failure to insufficient capital, heavy overhead charges and law costs, and states that he first became aware of his position in September, 1935.

B. Goldenberg (also known as Goldinberg), trading as B. Goldie & Co., 49, Deansgate, Manchester, dealer in electrical goods.—This debtor attended at the Court House, Quay Street, Manchester, recently, for his public examination. His statement of affairs showed a deficiency of £1,563. The examination was adjourned for further investigation.

F. V. Lambert, electrical contractor, 31, Harmer Street, Gravesend.—Last day for receiving proofs for dividend November 10th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2.

F. T. Wood (Wood & Jackson), electrical contractor, Boundary Works, Wragley Road, Lincoln.—Trustee, Mr. E. C. Midgley, 1, St. Swithin's Square, Lincoln, Official Receiver, released October 23rd.

J. W. Froggatt and **G. T. Shackleford** (F. & S. Radio), electricians, The Coneries, Loughborough.—Public examination December 4th at the Castle, Leicester.

D. Green (North End Radio), wireless factor, 250b, North End Road, Fulham, S.W.—Application for discharge to be heard on November 20th at Bankruptcy Buildings, Carey Street, W.C.

W. H. Colman (lately trading as Colman & Co.), electrical and radio engineer, c/o 37, Rowlands Road, South Yardley, Birmingham.—Trustee, Mr. R. K. Clark, 159, Great Charles Street, Birmingham, released October 16th.

H. Carnell, radio engineer, 94, East Hill, St. Austell, Cornwall.—Last day for receiving proofs for dividend November 11th. Trustee, Mr. C. Hancock, 12, Princes Street, Truro, Official Receiver.

W. A. Prince and **C. S. Prince** (Prince Bros.), electrical contractors, 18, Woodlands Road, Handforth.—First and final dividend of 11d. in the £, payable November 4th at 47, Mosley Street, Manchester.

Company Liquidations

British Automatic Refrigerators, Ltd.—Winding up voluntarily. Liquidator, Mr. W. E. Ogden, Audrey House, Ely Place, E.C.1.

B. & F. Carter & Co., Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. H. Bamford, 129, Entwistle Road, Rochdale. Reference to the new company is made in our "City Notes."

Brough Electric Lighting Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. F. Hopkinson, Exchange Chambers, Kendal. Particulars of claims to be sent to the liquidator by December 14th.

Private Arrangement

H. Jones, deceased, radio engineer, 129b, Dewsbury Road, Leeds.—The creditors interested herein were called together recently at the Law Institute, Leeds. The statement of affairs showed ranking liabilities of £1,370. Of that amount £1,232 was due to unsecured creditors, and there were contingent liabilities to finance companies under hire-purchase agreements of £768, of which, it was expected, £138 would rank. After allowing £10 for preferential claims the net assets were £1,390, leaving a surplus of £20. It was decided that the estate should be administered under a deed of assignment to Mr. E. Green.

Electricity Supply

Lighting, Domestic, Power

Barking.—LOANS.—Sanction is being sought by the Electricity Committee to a loan of £10,000 for mains and £5,000 for services.

Bath.—COMMITTEE'S CORONATION CONTRIBUTION.—The Electricity Committee proposes to allocate a sum of £500 toward expenses to be incurred in connection with the Coronation celebrations.

Becontree.—PURCHASE OF INSTALLATIONS.—Last December the London County Council approved a scheme for the installation of electricity in 12,504 houses at Becontree, in the area of the County of London Electric Supply Co., Ltd., and the work of wiring the houses is now well advanced. However, there are 1,000 houses on the Dagenham section of the estate which were wired by the County of London Co. without cost to the Council under an agreement in 1928, besides 1,200 houses wired under the company's assisted scheme at the request of the tenants, and to remove the anomaly of tenants in adjoining houses paying at different rates the Council proposes to buy these installations. The company has offered to accept £8,550, and the Council is recommended to approve this.

Belgium.—ELECTRICITY UNDERTAKING AS STEAM SUPPLIERS.—At the recent annual meeting in Brussels of the Société Intercommunale Belge d'Electricité the chairman stated that the proposal to establish a plant to supply steam as well as electric power to the numerous textile mills in the Verviers district had met with sufficient response to warrant the directors proceeding with the project. Consequently, a site had been secured near Verviers on which a steam producing plant was to be erected. The initial installation would comprise four boilers capable of supplying a total of from 120 to 160 tons of steam per hour.

Berwick (Northumberland).—ELECTRIC STREET LIGHTING.—The Scottish Southern Electric Supply Co., Ltd., has submitted terms to the Town Council for street lighting which virtually guarantee the Council a saving of £267 per annum immediately and still more in a few years' time.

Bexley.—LOWER CHARGES.—The Urban District Council has reduced the flat rate for lighting and wireless from 4d. to 3½d. per kWh and by prepayment meter from 5d. to 4d. per kWh. The "unit" charge under the all-in rate for domestic and business premises is lowered from ¾d. to ½d., and there is a modification in the rate for cinemas and places of amusement.

Birkenhead.—NEW PLANT.—Sanction to borrow £8,409 in respect of mains plant in connection with the supply to the Mersey Railway Co. has been obtained by the Electricity Committee.

SUB-STATION EQUIPMENT.—The Electricity Committee is seeking sanction to borrow £5,000 for sub-station equipment.

Bromley.—CORONATON SUPPLIES.—The Town Council has decided to supply electricity for Coronation illuminations from May 8th to 15th at the following rates: Flat rate, ¾d. per kWh; business two-part tariff, no additional standing charge and the usual "unit" charge of ¾d.

Chesterfield.—SUB-STATION EXTENSION.—The Corporation has applied for a loan of £12,607 for extensions to the Walton sub-station, following an application from the Chesterfield Tube Co., Ltd.. for an increased supply aggregating 3,000 kW. The object of the extension is to supplement present supplies from the Derbyshire & Nottinghamshire Electric Power Co. by the installation of additional bulk supply plant, with a capacity of 6,000 kW.

Chichester.—OVERHEAD LINES.—No objection is being raised by the Rural District Council to the use of overhead lines at Slindon and Malehurst by the Bognor Gas & Electricity Co., Ltd.

Coventry.—SPECIAL TARIFF.—To encourage the use of electricity for thermostatically controlled, low temperature apparatus for space heating the following special tariff has been introduced by the Electricity Department:—A flat rate of 0.525d. per kWh (subject to the usual 5 per cent. discount) on condition that the consumer provides the apparatus and limits its use to exclude the period from 4 p.m. to 6 p.m. on Mondays to Fridays inclusive during the months of November, December, January and February.

MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £3,517.

Derby.—IMMERSION HEATER CONCESSION.—The Town Council has reduced the hire charge for immersion heaters from 3s. to 2s. 6d. per quarter.

ELECTRIC HEATING.—Authority has been given for the acceptance of the tender of the Electricity Department of £1,314 for electric heating apparatus to be included in the new Technical College buildings. It was stated that the change would involve an extra capital expenditure of £500, but there would be a saving of £50 a year compared with the original plan for solid fuel heating.

Douglas.—POWER PLANT EXTENSION.—Last week Sir Montagu Butler, Lieutenant-Governor of the Isle of Man, started up an extension to the plant at the Pulrose power station by intercepting a ray of light in a marquee which had been erected for the occasion on the lawn in front of the power station. The extension involved enlargement of the building and the installation of a 3,750-kW turbo-alternator, a 40,000-lb. boiler, evaporating plant, cooling tower, house service set and switchgear to the specification of Mr. Bertram Kelly, the borough electrical engineer. The Pulrose power station of the Douglas Corporation supplies electricity not only in the 17 sq. miles of the Corporation's area, but in bulk to the Isle of Man Electricity Board for distribution outside this area.

East Ham.—REMOTE CONTROL APPARATUS.—The electrical engineer and manager and the chairman of the Electricity Committee recently visited Paris to investigate the possibilities of a new form of remote control apparatus, and a comprehensive report on the subject is to be submitted to the Council. The chairman of the Committee stated that the engineer and himself visited a sub-station in Paris where machinery of the type was in operation The apparatus might save the borough a considerable sum of money. No machinery of the kind had yet been installed in England.

Fleetwood.—POPULARITY OF ELECTRICITY IN THE HOME.—Ninety-five per cent. of the houses in the town are now supplied with electricity. Electric cookers installed number 1,666, being an average of one cooker to every four families. As regards immersion heaters, Fleetwood has 29 to every 100 of the population.

Foots Cray.—COMPANY ABSORBED.—The Foots Cray Electricity Supply Co., Ltd., has been absorbed by the County of London Electric Supply Co., Ltd., the largest supply organisation in the country. As a result, consumers are benefiting by reductions in charges. The two-part tariff running charge of the Foots Cray Co. is being reduced from 1d. to ¾d., and the power rate by ¼d. per kWh. The rates to consumers will thus be uniform in adjoining areas of West Kent which now come under the control of the County of London Electric Supply Co., Ltd.

Hastings.—ELECTRICITY AT HOLLINGTON.—Cables are to be laid by the Corporation at an estimated cost of £5,350 for lighting the new housing estate at Hollington.

Ilford.—NEW EQUIPMENT.—Sanction has been obtained to borrow £3,668 for mains and £4,908 for plant (sub-station equipment).

Keighley.—CORONATION ILLUMINATION SUPPLIES.—Electricity is to be supplied for the exterior illumination of premises in connection with the Coronation celebrations at the net price of ¼d. per kWh.

LOAN.—For the provision of domestic appliances the Electricity Committee is seeking sanction to borrow £10,000.

London.—BATTERSEA.—Sanction is being sought by the Electricity Committee to loans of £28,000 for mains and services and £20,500 for hire-purchase installations. Permission has been obtained to borrow £6,000 for sub-station equipment.

HAMMERSMITH.—In order to continue the hire of a number of old-type black stove-enamelled cookers which the Electricity Department has in stock and which are quite serviceable when reconditioned, it has been decided to reduce the quarterly rentals from 8s. to 6s. 3d., and from 6s. 3d. to 5s. An additional hire charge of 6d. per quarter is to be made in respect of radiant-heat boiling plates when supplied with any cookers in place of the ordinary type of boiling plate.

A recent canvass showed that the tenants of 176 of the 246 flats on the Cleverly estate wished for a supply of electricity, and the Corporation is accordingly furnishing the required facilities.

The Council has decided to extend the length of free service cable from 30 to 40 ft.

L.C.C.—The electrical installation at Ardale School, Essex, is to be renewed by the Council and the existing d.c. motors replaced by the a.c. type at a cost of £2,360.

ST. PANCRAS.—Further improvements of street lighting are contemplated by the Electricity and Public Lighting Committee, which has recently installed electric-discharge lamps in several important thoroughfares. Various schemes have been submitted, but only £2,500 is allowed in the current estimates for general street lighting improvements, and the Committee therefore proposes to deal with part of Euston Road first, leaving the other roads for future treatment.

Electricity required for decorative lighting during the Coronation celebrations is to be charged for at ½d. per kWh, the period not to exceed one month.

The Electricity Committee is seeking sanction to borrow £79,878 for extensions.

Macclesfield.—CHEAPER ELECTRICITY.—The Electricity Company of Macclesfield, following representations by the Corporation, has made concessions in electricity tariffs. These include a reduction in the domestic power tariff from 2d. to 1½d. per kWh, and a modification of the rateable value tariff. Shop window lighting will be reduced from 3d. to 1½d. per kWh. and the company proposes to introduce a business premises heating tariff for such apparatus as office radiators.

Manchester.—POWER STATION EXTENSION.—The Central Electricity Board has intimated its intention of issuing a direction to the Corporation for the extension of the Stuart Street generating station by the installation of a 33,000-kW turbo-generator.

Mountain Ash.—CHEAP ELECTRICITY.—The Council has again decided to reduce the lighting flat rate to ¾d. per kWh for the December quarter. The electrical engineer informed the Council that if the recommendations of the McGowan Committee were adopted by the Government it would probably

mean that the price of electricity to consumers would be increased to 4d. or 5d. per kWh.

Nantwich.—SUPPLY TO BADDINGTON.—The Urban District Council has consented to the Electricity Distribution of North Wales and District, Ltd., erecting an overhead line in connection with a supply of electricity to Baddington.

Newcastle-on-Tyne.—LIGHTING BEACONS.—The City Council has been notified by the Ministry of Transport that no contributions will be given towards the cost of illuminating Belisha beacons and, in addition, it is stated that any departure from the standard beacon may result in the withdrawal of contributions already made or promised by the Ministry. Newcastle has over 100 beacons, and the city lighting superintendent has submitted a report stating that 75 per cent. of these cannot be seen in the dark. The City Council is now to experiment with reflector-studded beacon globes and standards, and if these fail the lighting superintendent will carry out tests with spotlight beams focused on the beacons.

Northern Ireland.—AID FOR FARMERS.—In the Ulster Parliament recently it was stated that the question of providing facilities for the extension of supplies of electricity in rural areas to farms or groups of farms had recently been engaging the attention of the Electricity Board and of the Ministry of Finance. The Electricity Board as a self-supporting, albeit non-profit-earning, body must have regard to ordinary commercial considerations in the conduct of its business. It followed that before sanctioning extensions in rural areas some assurance must be forthcoming that there would be an adequate return in revenue to cover the necessary payments of interest and sinking fund on the capital expenditure involved. However, the installation of electricity on farms involving either the installation of self-contained sets or the linking up of the farms with the Board's distribution system, being a work of capital improvement, came within the scope of the Landed Property Improvement Acts, and loans on the usual terms could be made to farmers where the Ministry was satisfied that the provision of such a supply would increase proportionately the economic value of the holding.

Oban.—CHEAPER ELECTRICITY.—The Town Council has agreed to reduce the charges for electric lighting from 6d. to 5d. per kWh, and for power from 3d. to 2d. per kWh.

Reading.—NO OPPOSITION TO IMPORTANT LIGHTING SCHEME.—Last July the Council decided to make application for permission to borrow £36,693 for improving the street lighting of the borough by electricity, and recently a Ministry of Health inquiry was held in connection with the matter. There was no opposition. The Mayor (Councillor W. H. Bale) said that for many years there had been a demand by members of the Council and the general public for improved street lighting, and the matter had been carefully considered. They came to the conclusion that electricity was superior in illumination power and from the financial point of view. The Council was quite satisfied with the experimental lighting in Oxford Road and in the secondary streets, which had proved that electric lighting was far more economical.

Scarborough.—SUB-STATION.—Negotiations are being continued by the Electricity Committee for the purchase of a site at the junction of Scalby Road and Woodland Ravine for a sub-station.

SUPPLY EXTENSIONS.—The Town Council proposes to extend its electricity supply from Scalby to Hackness in order to afford a supply to the estate of Lord Derwent.

Slough.—ELECTRIC-DISCHARGE LIGHTING.—It is proposed to install mercury vapour electric-discharge lamps at Salt Hill and along Farnham Road at a cost of £1,379.

Smethwick.—UNDERGROUND CABLES.—Permission has been granted by the Corporation to the Shropshire, Worcestershire and Staffordshire Electric Power Co., to lay an underground high-voltage cable across land at Quinton belonging to the Corporation.

Southend-on-Sea.—NEXT YEAR'S ILLUMINATIONS.—The Illuminations Committee recently reported to the Council that certain features should be varied and extensions effected if the illuminations were to continue to prove as attractive as in the past. It therefore proposed a capital expenditure of £1,600 on set-pieces to be placed on the mud flats and £1,840 on alterations and additions to the illuminations on the Western Esplanade. The cost, it was suggested, should be borne by the general rate and the electricity undertaking. In addition, it was proposed to provide new features in the Shrubbery at a cost of £2,000, this to be met out of the Shrubbery receipts. The total amount to be met out of the rates in the coming year in respect of the illuminations would be approximately £8,950.

South Shields.—CHANGE-OVER.—The Electricity Commissioners have sanctioned the borrowing of £21,264 by the Town Council in connection with the reorganisation of the electricity undertaking. The Commissioners suggest that the Council should take £10,000 from the reserve fund for the change-over of consumers' apparatus, and it has been decided to do this.

Stirling.—SUB-STATION.—A recommendation to erect a new sub-station to supply the increasing load in Drip Road has been approved by the Electricity Committee.

Todmorden.—EXTENSIONS.—A supply of electricity is to be provided by the Corporation to the Fielden Joint Hospital and the Stansfield View Institution.

Torquay.—OVERHEAD EXTENSIONS.—A scheme recommended by Messrs. Kennedy & Donkin for the extension of the transmission system from Newton Abbot to Torquay and from Newton Abbot to Paignton, Totnes and Kingsbridge by means of overhead 33-kV lines and ancillary apparatus has been approved by the Electricity Committee. The work will cost £118,000.

United States.—OIL-FILLED POWER TRANSMISSION CABLE.—What is stated to be the first power transmission line in America consisting of an oil-filled, single-conductor, 66,000-V cable has recently been put into service between the Crawford generating plant and the Humboldt Park distributing stations of the Commonwealth Edison Co., Chicago. The conductor size is 2,100,000 cir.mil except for a small amount of 2,800,000-cir.mil cable used in the congested conduits. Although the nominal rating of the new line is 100,000 kVA, its maximum carrying capacities in summer and winter are respectively 115,000 and 135,000 kVA, these ratings being more than double the comparable ratings for the former standard cable (750,000 cir.mil). The diameter is stated to be about the same in both cases. The oil in the new cable has the consistency of paraffin and is maintained under constant pressure.

Willesden.—CORONATION LIGHTING FREE.—The Council has agreed to supply electricity free for floodlighting and illumination purposes during the period from May 11th to 16th next inclusive. There will be a charge of 5s. per installation.

Wolverhampton.—ADDITIONAL SUPPLIES.—A scheme for affording additional supplies to the Star Aluminium Co., Ltd., at an estimated cost of £2,622 has been approved by the Town Council.

MAINS EXTENSIONS.—Plans for the extension of mains to Bushbury (£778), Moreton Estate, Oxley (£1,526), and small holdings at Bilbrook (£151) have been passed by the Electricity Committee.

Worthing.—SUPPLY TO ESTATE.—The Electricity Committee is to provide a supply to the Seaview estate, Sompting, at a cost of £1,350.

Progress of the Liffey Scheme

THE publication by the Irish Free State Government of the text of the Liffey Reservoir Bill marks a further step in the £1,200,000 scheme for the development of the River Liffey as an additional source of electrical energy for the Electricity Supply Board.

The Bill seeks to empower the Board to impound the waters of the river and generate electricity by water power, supplementing the present power station at Ardnacrusha, Limerick. It is estimated that the yearly average production of the Liffey scheme would be about 30 million kWh. Last year the combined output of the Shannon scheme and the Pigeon House power station, Dublin, was 187 million kWh.

By the terms of the Bill the Electricity Supply Board is empowered to have the work done by contract, and provision is made for the adequate compensation of persons whose lands are taken over under the scheme. A schedule to the Bill embodies the agreement between the Dublin Corporation and the Electricity Supply Board, made on June 18th, 1936. This provides for the construction of a reservoir and hydro-electric works at Poulaphouca Gorge. Provision is also made for the scheme to proceed in two stages. The first is to consist of such works as may be necessary to provide a top water level in the reservoir of at least 576 ft. This is to be completed before January 1st, 1940. The second will consist of such further works as may be necessary to raise the top water level of the reservoir to 610 ft. Failure to comply with this agreement as regards the completion of the first stage by the date stated involves the Electricity Supply Board in the payment to the Corporation of £50 per day. The second stage must be carried out by March 31st, 1950, on penalty of a fine of £25 per day.

The Electricity Supply Board is to control and regulate the sluices from the reservoir, and will at all times be at liberty, without restriction, to utilise the water of the reservoir for power development so long as the water is not below low water level.

On the question of cost the agreement provides that the Corporation shall pay to the Board, as a contribution to the construction of the reservoir, the sum of £126,000. This, paid on completion of the first stage, is to be accepted by the Board as a full and complete discharge of the Corporation's liabilities.

The Board will be under no liability to the Corporation if for any natural reason, such as defects in the soil or the rock, the construction of the reservoir proves impracticable.

Traction

Australia.—PROFIT FROM TRAMWAYS.—The Western Australian Government Tramways earned £285,899 in the year ended June 30th last, and after deducting working expenses and interest charges there was a surplus of £1,750 on the year's working. A service of trolley-buses showed a deficiency on the year largely owing to depreciation being charged on three vehicles, whereas the route was within the capacity of two. It is proposed to extend the service and also to convert further tramway route to trolley-bus operation.

Canada.—ELECTRIC RAILWAY TRAFFIC.—The traffic of electric street and suburban railways in Canada continued to increase during 1935, although the improvement over 1934 was not as great as the increase of 1934 traffic over 1933. Fare-paying passengers carried during the year numbered 600,728,313, against 595,143,903 in 1934 and 585,385,094 in 1933. The number, however, was less than for any previous year during the past decade. Total revenues of all systems increased from $40,048,136 in 1934 to $40,442,320 and, with a reduction in operating expenses from $28,036,754 to $28,009,013, net operating revenues were increased from $12,011,382 to $12,433,307.—*Electrical News and Engineering.*

Glasgow.—MODERN TYPE OF TRAMCAR.—A new streamlined tramcar which will be put into service towards the end of the year has loudspeaker apparatus for the driver to announce the stopping places. The saloons are warmed by tubular heaters and air-conditioned by a system designed to change the air in the vehicle forty-five times an hour under running conditions and ten times an hour when stationary. The vehicle is fitted with dipping head lamps, fog lamps, windscreen wipers, and direction indicators. It seats sixty-five passengers.

Hull.—COLOUR-LIGHT SIGNALS.—The signalling system along the approaches to Paragon Station, Hull, is to be converted from the semaphore to the colour-light type. Two existing signal boxes will be replaced by one with push-button controls (in place of mechanical levers) and a panel showing all the signals and switch points on that section of the line.

Norway.—ANOTHER ELECTRIFIED LINE.—The Kongsberg and Hjuksebo lines of the Norwegian State Railways have been electrified on the standard 15-kV, single-phase system. The total length converted is about 57 miles, and forms virtually an extension of the Oslo-Drammen suburban line.

Sunderland.—EXTENSION OF TRAMWAY.—The Town Council is to seek Parliamentary powers to extend its tram track farther into the Humbledon district, where there has been a good deal of building development recently.

Walsall.—TROLLEY-BUSES.—A large scheme for the use of trolley-buses is to be the subject of a special meeting of the Town Council. It is proposed to introduce the trolley-buses in Townsend Street and St. Paul Street, Walsall, between Walsall and Wednesbury, in Darlaston Grove and Walsall Road to the Walsall borough boundary, &c. The trolley-bus would, it is understood, replace the present petrol buses in the districts named.

Communications

Argentina.—TELEPHONE PROGRESS.—The Posts and Telegraphs Department recently published statistics regarding the use of the telephone throughout the Republic showing that in 1926 the lines extended to 38,225 kilometres and in 1934 to 47,706 km., with 762,032 km. of wiring in use in 1926 and 1,941,852 km. in 1934. The number of subscribers for the same two years was 168,402 and 273,287, respectively. The capital invested in telephones in 1926 amounted to 105,257,627 pesos and in 1934 to 356,666,745 pesos. Receipts also increased from 27,479,604 to 51,391,596 pesos and expenses from 22,479,604 to 39,114,985 pesos. In 1922 there were 97 companies operating telephone services with 6,904 employés. In 1930 the figures were 44 and 13,405, and in 1934 42 and 10,604. The large decrease in the number of employés in recent years is due to the adoption of automatic services, which at the end of 1934 amounted to 65.62 per cent. of the whole.—*Review of the River Plate.*

Far East.—BROADCASTING RIVALRY.—Following reports that both the Japanese and Soviet Governments have decided to expand their radio broadcasting systems, the Nanking Government is being urged to do the same, states a *Reuter* message from Shanghai. At present, Japan is reported to be planning to erect a 150-kW broadcasting station at Nagasaki in reply to the 100-kW Soviet station at Habarovsk, in Siberia. At present the most powerful station in China is that of 75 kW at Nanking. In view of its realisation of the value of broadcasting from a propaganda point of view, however, the Chinese Government is now likely to make an early and substantial increase in the power of this station.

Great Britain.—TELEVISION.—On Monday afternoon we "looked-in" to the inauguration of the first British public television service using high definition. Speeches were made by Mr. R. C. Norman, Major Tryon, Lord Selsdon, Sir Harry Greer (chairman, Baird Company), and Mr. Alfred Clark (chairman, E.M.I.). The whole programme was radiated first by the Baird system of 240 lines, 25 frames and repeated shortly afterwards on the Marconi-E.M.I. system of 405 lines (interlaced), 50 frames, two "Emitron" cameras being used in the latter case to give rapid change from close up to general views.

Passenger Transport in Greater London

ELECTRIC traction has engaged the attention of the London Passenger Transport Board to a large extent in the year to June 30th last, surveyed in its third annual report. Of the £3,725,169 of capital expenditure incurred during the period, £1,162,638 was for the electrical equipment of trolley-bus routes, new rolling stock, &c.; £769,621 for improvements to the railway system, such as the provision of escalators, modifying the signalling and lighting, and new rolling stock; while £263,789 was in respect of improvements to the electric power supply.

Traffic peaks on the railways have been a source of much concern, as already the Board's services are in many instances being operated at their maximum capacity, and the Board sees a solution only in a spread of the peaks by a wider distribution of the hours at which people begin and end their work. Abatement of noise on the tube railways has also received much thought, and the Board is satisfied that this can be effected on a large scale by welding rail joints, introducing sound-absorbing pads in the tunnel walls and changing the brake blocks from iron to fibre.

With regard to trolley-buses, the Board owned 300 of these at June 30th last as compared with 63 a year before. The cost of operation has not yet been finally ascertained, but the results are considered sufficiently satisfactory to justify the Board in arriving at a general decision to complete the substitution of trams.

Passenger journeys originated in the Board's area during the year were distributed among the various forms of transport as follows (comparative figures for the previous year in parentheses) :—

	Number.		Percentage of total.
Buses and coaches	2,127,498,934	(2,094,764,436)	58 (59)
Trams	983,012,848	(1,013,433,692)	27 (28)
Railways	467,869,687	(445,888,289)	13 (12)
Trolley-buses	69,581,164	(28,262,013)	2 (1)
	3,647,962,633	(3,582,348,430)	

The number of passenger journeys dealt with within the pooling scheme with the main-line railway companies was 4,214,955,963, against 4,129,440,702, representing 440 journeys per annum per head of the population served (estimated at 9,575,000) as compared with 436 in the previous year (population estimated at 9,500,000).

The Board's share of the £40,606,339 traffic receipts was £29,532,879, to which is added certain miscellaneous receipts, making £29,724,723 (£29,016,085 last year). It is stated that the rate of traffic expansion in the Board's area has slowed down, the increase of £708,638, or 2.44 per cent., being less than was anticipated. Working expenses, excluding provision for renewal, amounted to £23,515,821 (£22,515,889).

Electricity generation at the Lots Road, Neasden and Greenwich power houses cost £921,882 and high-voltage supplies purchased from other undertakings cost £123,105. Distribution expenses were £437,922, making the total cost £1,482,909, or 0.511d. per kWh against 0.526d. in the previous year. Electricity supplied for the operation, lighting and heating of trains, trams and trolley-buses was 616,656,815 kWh, and the total of all supplies was 696,858,727 kWh.

The dividend of 4 per cent. paid on the London Transport "C" stock is the same as last year.

Faraday House Old Students

The twenty-eighth annual dinner of the Faraday House Old Students' Association was held on October 30th, at the Savoy Hotel, W.C., when some 400 members and guests assembled under the chairmanship of Mr. H. W. Swann, the president of the Association. Mr. H. T. Young (pres., I.E.E.), proposing the toast of "Faraday House," referred to its position as the largest college engaged solely in electrical education. The "sandwich system" of training adopted was no doubt a great factor in the success of its pupils, but most was due to the principal, Dr. Russell. Dr. Alexander Russell, responding, said that of ten old Faradians serving on the Council of the I.E.E., four had passed the presidential chair. Twenty-five years ago pupils numbered 77; the present figure was 340. They had had over 3,000 since the opening of the college, most of whom occupied responsible positions, Callender's accounting for forty. The 209 appointments obtained this year by old Faradians constituted a record. The health of "The Guests" was put by Mr. A. W. Beuttell, who referred to the presence of nine past presidents and four vice-presidents of the I.E.E., in addition to the new president. Response was made by Sir Alexander Gibb and by Sir John Burke, and the health of the chairman was proposed by Mr. P. L. Riviere.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberdare.—November 18th. U.D.C. Electricity Department. One 300-kVA transformer. (See this issue.)

Argentina.—BUENOS AIRES.—November 24th. State Railways Administration. Fourteen portable electric arc welding sets. (T.Y. 30898.)*

December 1st. State Oilfields Directorate. Copper wire, flexible cable, conductors, plugs, sockets, &c. (T.Y. 30913.)*

Barnstaple.—November 16th. Corporation. One 10-ton overhead crane for the power station extensions, Castle Street. (October 23rd.)

November 30th. Corporation. Motor generator, switchgear and connecting cables. (See this issue.)

Batley.—November 10th. Electricity Department. E.h.v. and l.v., p.i., l.c., armoured cables for the period ending December 31st, 1937. P. M. Manwell, borough electrical engineer, Electricity Works, George Street.

Birkenhead.—November 16th. Corporation. Electrical materials for one year. (October 30th.)

Birmingham.—November 9th. Electric Supply Committee. Meters for six months. (October 30th.)

Blackpool.—November 20th. Borough Council. Twenty single-deck tramcars complete, or alternatively of bodies, trucks and electrical equipment. General Manager, Transport Department, Blundell Street.

Brighton.—November 23rd. Mental Hospital Visiting Committee. Electrical wiring installation at the new Admission Hospital, Haywards Heath. (See this issue.)

Buckhaven and Methil (FIFESHIRE).—Town Council. Electric lighting at housing estate. E. L. Forsyth, architect and surveyor, Methilbrae, Methil.

Carlisle.—November 20th. Corporation. Meters for one year. (See this issue.)

Chesterfield.—November 12th. Electricity Committee. Equipment for the extension of one 33,000-V outdoor sub-station, complete with switchgear, transformer, and induction regulator; also three miles of h.v., p.i., l.c., and armoured cable, with pilot cables. (October 30th.)

Cleethorpes.—November 23rd. U.D.C. Equipment with necessary material for 2¼-miles of trolley-vehicle overhead construction, to include turning circles and depôt equipment; or, alternatively, the supply of tubular steel poles, trolley and galvanised steel wire and overhead fittings. A. S. Barter, clerk to the Council, Council Offices.

Dunfermline.—November 11th. Town Council. Electrical work at housing estate. Burgh engineer (deposit £1).

East Barnet.—November 16th. U.D.C. Six electrically operated, horizontal-spindle, centrifugal pumping units and two electrically operated, vertical-spindle, centrifugal pumping units. C. M. Barnes, engineer, Town Hall, Station Road, New Barnet, Herts (deposit £5 5s.).

East Grinstead.—November 21st. U.D.C. Electric cookers for one year. (See this issue.)

Erith.—November 8th. U.D.C. Electricity Department. One electric vehicle. (See this issue.)

Felixstowe.—November 12th. U.D.C. Electricity Department. Cable. (See this issue.)

Fife.—November 18th. County Council. Electric lighting at the Windygates housing estate. J. Gentles & Son, Central Chambers, Kirkcaldy (deposit £1 1s.).

Electrical installations at new workshops at Fife Mining school, Cowdenbeath. Particulars from G. Sandilands, County master of works, Property and Works Department, County Offices, Kirkcaldy (deposit £1 1s.), by November 11th.

Flaxton.—November 7th. R.D.C. Underground sewage pumping stations, consisting each of duplicate, electrically driven, automatically controlled pumping sets; and the conversion of existing pumping station by provision of new machinery at Skelton Rawcliffe, Clifton, Huntington, Earswick, Wigginton, Haxby and Osbaldwick. Fairbank & Son, Barclays Bank Chambers, St. Helens Square, York (deposit £3 3s.).

Glasgow.—November 17th. Corporation. 25,000-kW steam turbo-alternator, with condensing plant and auxiliaries. (October 30th.)

November 18th. Education Department. Electrical work at Croftpark school. Education Offices (Property Department), 129, Bath Street (deposit £1 1s.).

Halifax.—November 16th. Parks Committee. Heating conservatories at Akroyd Park, Belle Vue Park and Manor Heath, by electricity, or, alternatively, l.p. hot water. D. T. Lloyd Jones, borough engineer, Crossley Street (deposit £2 2s.).

Hastings.—November 12th. Borough Council. Transformers, poles, stay blocks and steelwork, &c., for overhead lines, during one year. (October 30th.)

Kingston-upon-Thames.—December 2nd. 3,300-V sub-station switchgear. (See this issue.)

Kirkcaldy.—November 9th. Town Council. Electric lighting, heating, power, and call-bell installation at the new fire station buildings. Burgh electrical engineer, Electricity Works, Victoria Road.

Leeds.—November 12th. Transport Committee. One 500-kW automatic mercury arc, steel tank rectifier equipment, complete with e.h.v. and l.v., d.c. switchgear. (See this issue.)

Lincolnshire.—November 9th. Joint Board for the Mentally Defective. Engineering works, including electric lighting and power installation, fire alarm points, &c., in two new villas at the Harmston Hall Mental Colony, Lincoln. (See this issue.)

London.—BETHNAL GREEN.—November 13th. Borough Council. One 1,000-kVA transformer, with on-load auto-tap changing device, and one ring main tee-off isolating equipment. (October 30th.)

HACKNEY.—November 25th. Borough Council. Electrical installation for a block of 311 flats at Nisbet Street, E.9. (See this issue.)

December 21st. Two steam generating units and ancillary plant, and one 30,000-kW turbo-alternator, with condensing plant, &c., for the Millfields Road generating station. (See this issue.)

Manchester.—November 11th. Electricity Committee. Automatic telephone equipment at the Town Hall, and power stations, &c. (October 23rd.)

November 27th. Two 130,000-lb. per hr. boilers, economisers, &c., for the Stuart Street power station. (October 30th.)

November 16th. Rivers Committee. Electrical equipment, including lighting and power cable work, for the sludge digestion plant and sludge storage tanks at the Davyhulme sewage works. City Engineer's Office, Town Hall (deposit £2 2s.).

Middlesbrough.—November 21st. Education Committee. Electric lighting and power installation at the Whinney Banks Council school. Particulars from the Director of Education, Education Offices (deposit £1 1s.), by November 11th.

Middlesex.—November 30th. County Council. Electrical bed, passenger, and goods and service lifts in the extensions at Redhill County Hospital, Edgware. (October 30th.)

November 26th. Electrical installations in connection with the extensions at the Southall Technical College. (October 30th.)

New Zealand.—AUCKLAND.—November 30th. Electric Power Board. Twenty 200-kVA and twenty 300-kVA transformers. (T.Y. 30909.)*

WELLINGTON.—January 7th. Post and Telegraph Department. Secondary cells. (T.Y. 30910.)*

January 26th. Public Works Department. Four 750-kVA transformers. (T.Y. 30911.)*

Northern Ireland.—BELFAST.—November 14th. Electricity Committee. Battery-driven electric vehicles; 6.6-kV armour-clad switchgear; and centrifugal oil purifying equipment with pipework. (October 30th.)

November 30th. Harbour Commissioners. Stores, including electrical fittings, for one year. M. J. Watkins, general manager and secretary, Harbour Office.

Ormskirk.—November 9th. U.D.C. Electrical pumping plant at the Greetby Hill waterworks. J. Hadyn Thomas, clerk to the Council, Council Offices (deposit £3 3s.).

Radcliffe.—November 16th. Electricity Department. 200-, 300- and 500-kVA transformers. (October 23rd.)

Rochdale.—November 24th. Electricity Committee. Quarterly and prepayment meters for twelve months. (October 23rd.)

St. Andrews.—November 16th. Town Council. Electrical work at 160 houses. J. C. Cunningham, architect, 10, Alexandra Place (deposit £1 1s.).

St. Helens.—November 12th. Electricity Department. Salt glazed, stoneware ducts and cable protection tiles; and h.v and l.v., p.i. cables. (October 30th.)

Shipley.—November 13th. U.D.C. Electric-discharge street lighting equipment. (See this issue.)

South Shields.—November 26th. Corporation. Electrical fittings and lamps for one year. (See this issue.)

Stoke-on-Trent.—November 11th. Electrical Engineer's Department. 600-Ah, 60-cell battery at Hanley sub-works. (October 30th.)

South Africa.—STELLENBOSCH.—December 1st. Municipality. H.v. cables, cable boxes and transformers. (T.Y. 30891.)*

Thurrock.—November 11th. U.D.C. 110-kW alternator, switch and control gear, and interconnections between main and auxiliary equipment at the main drainage works, Marsh Farm, West Tilbury. (October 30th.)

Uruguay.—MONTEVIDEO.—December 8th. State Electricity Supply and Telephones Adminstration. Porcelain insulators, switches, cut-outs, lampholders, &c. (T.Y. 30875.)*

November 19th. Switch cabinets for long-distance telephone lines, distributors, wiring, &c. (T.Y. 30880.)*

November 26th. Bare copper wire for telephone lines. (T.Y. 30902.)*

Walsingham.—November 16th. R.D.C. Automatic, electrically operated, motor driven well pumps in duplicate (each capable of delivering 7,500-gal. per hr.), and incidental works, at the pumping station, Fakenham. A. P. I. Cotterell & Son, 54, Victoria Street, London, S.W.1. (deposit £3 3s.).

West Ham.—November 9th. Electricity Department. Coal for power station for one year. (October 23rd.)

West Hartlepool.—November 19th. Electricity Department. Fire-fighting equipment at the Burn Road sub-station. (See this issue.)

West Riding.—November 23rd. County Council. Electric lighting at Otley North Parade Council school. Education officer, County Hall, Wakefield.

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Barking.—Housing Committee. Accepted. Electrical installations at Upney Lane flats (£729) and Blake Avenue houses and flats (£659).—Holliday, Hall & Stinson, Ltd.

Electricity Committee. Accepted. Cables.—Telegraph Construction and Maintenance Co. (£908); St. Helens Cable & Rubber Co. (£952).

Birkenhead.—Electricity Committee. Accepted. Two 500-kVA transformers (£372) and five l.v. switchgear units (£425).—G.E.C. Three e.h.v. switchgear units (£742).—A. Reyrolle & Co.

Cheltenham.—Electricity Committee. Accepted. Cables for twelve months.—Hackbridge Cable Co.

Dover.—Town Council. Accepted. Replacements in connection with the change-over: Motors on consumers' premises (£473).—Higgs Motors, Ltd. Domestic apparatus (£627).—Collins Electrical, Ltd.

Durham.—County Education Committee. Accepted. Electrical installations at schools: Beamish Council (£148), Pelton Council (£189), and Tanfield Burnopfield Leazes Council (£91).—T. W. Atkinson. Billingham New Council (£168) and Ryhope Secondary (£154).—W. E. Dove & Co.

Glasgow.—Police Committee. Accepted. Electrical installations at the Queen's Park first station (£262).—W. S. Watson.

Transport Committee. Accepted. Trolley wire.—W. F. Dennis & Co. (representing Felten and Guilleaume).

Leeds.—Housing Committee. Accepted. Electric lighting installations on the Gipton estate: 318 houses (£1,375).—J. Edward. 378 houses (£1,569).—F. Marshall & Co. (Electricians), Ltd.

London.—METROPOLITAN WATER BOARD.—Recommended. Extension of internal telephone system at Head Offices (£496).—Automatic Telephone & Electric Co.

L.C.C.—Wiring and fittings for electric lighting, &c., in blocks 2 and 3 of dwellings in the Pott Street area, Bethnal Green:—

	£		£
Springvale Electrical Co. Accepted	1,371	Carr Bros....	1,435
Archibald Meckhonik	1,407	Pinching and Walton	1,517
Evans and Shea	1,413	Berkeley Electrical Engg. Co. ...	1,523
		Ryland's Electrical Co.	1,786

Electric passenger lift in Nurses' Home, Grove Park Hospital, Lee (£756).—W. Wadsworth & Sons.

Scarborough.—Town Council. Accepted Overhead electrical equipment required in connection with the supply of electricity to Headon Lodge, Wydale (£170).—Johnson & Phillips.

Shipley.—Electricity Committee. Accepted. Three transformers (£470).—Foster Engineering Co.

South Shields.—Town Council. Accepted. Equipment for a proposed new sub-station in Dean Road (£1,594).—Hewittic Electric Co.

Weymouth.—Housing Committee. Accepted. Electrical installations in 140 houses on the Goldcroft estate (£1,400).—Bennett & Escott.

Worthing.—Electricity Committee. Accepted. Two 200-kV transformers (£151 each).—Yorkshire Electric Transformer Co.

Forthcoming Events

Institution of Electrical Engineers.—Monday, November 9th. Institution, London, W.C.2. 7 p.m. Informal meeting. Discussion on "The Relative Costs of Electrification of Rural and Urban Areas." To be opened by Mr. J. A. Sumner.

Mersey and North Wales (Liverpool) Centre.—Friday, November 6th. Reeces', Parker Street, Liverpool Benevolent fund dance.

Meter and Instrument Section.—Friday, November 6th. Institution, London, W.C.2. 7 p.m. Inaugural address by Mr. G. F. Shotter, chairman. Friday, November 13th. Holborn Restaurant, London, W.C.1. 6.45 for 7 p.m. Dinner.

North-Eastern Centre.—Friday, November 6th. Literary and Philosophical Society, Newcastle-upon-Tyne. 7 p.m. Joint meeting with the North-East Coast Institution of Engineers and Shipbuilders. Parsons Memorial Lecture. "Sir Charles Parsons and Steam." Sir Frank E. Smith. Monday, November 9th. Armstrong College, Newcastle-upon-Tyne. 6.15 p.m. "Recent Developments in Telegraph Transmission, and Their Application to the British Telegraph Services." Messrs. L. H. Harris, E. H. Jolley and F. O. Morrell.

Western Centre.—Monday, November 9th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Recent Progress in Induction-Motor Construction." Mr. L. H. A. Carr.

North Midland Centre.—Tuesday, November 10th. Hotel Metropole, Leeds. 7 p.m. Paper by Messrs. L. H. Harris, E. H. Jolley and F. O. Morrell.

Scottish Centre.—Tuesday, November 10th. North British Station Hotel, Edinburgh. 7 p.m. Inaugural address by Mr. H. C. Babb, chairman.

Hampshire Sub-Centre.—Wednesday, November 11th. Municipal College, Portsmouth. 7.30 p.m. "Electrical Characteristics of 132-kV Line Insulators Under Various Weather Conditions." Mr. J. S. Forrest.

Transmission Section.—Wednesday, November 11th. Institution, London, W.C.2. 6 p.m. Inaugural address by Mr. P. Dunsheath, chairman.

Dundee Sub-Centre.—Thursday, November 12th. University College, Dundee. 7.30 p.m. "Magnetic Separation." Mr. A. E. Crawley.

Electrical Industries Benevolent Association *(Birmingham and District Branch).*—Friday, November 6th. Magnet Club, Witton, Birmingham. Annual dance.

Association of Supervising Electrical Engineers.—Monday, November 9th. Royal Hotel, Bristol. 7.15 p.m. "Transformers and Their Applications." Mr. E. T. Norris.

Electrical Power Engineers' Association *(South-West Section).*—Tuesday, November 10th. Royal Hotel, Cardiff. 7.45 p.m. "Earths and Earth Testing." Dr. Tagg.

Midland Electrical Engineers' Ball.—Friday, November 13th. Grand Hotel, Birmingham.

Notes

Mr. E. Brook's Gift to E.I.B.A.

We learn from Mr. A. Hugh Seabrook, Executive Officer of the Electrical Industries Benevolent Association, that Mr. Ernest Brook, of Huddersfield, has signed a seven years' Deed of Covenant (£1,000) entitling him to the position of patron of the Association. The following gentlemen have also signed seven-year Deeds:—Sir Montague Hughman, Sydney E. Britton, A. E. Sparrow, E. A. Deacon, Ernest Lefeaux, F. F. Elliott, Ernest L. Joseph, W. Bishop, C. Kibblewhite, E. Charlton, Charles Hodges, Sidney Haslam, C. P. W. Rand, John S. Pickles, A. S. Black, J. H. Farthing, H. Wilson, James W. Arthur, A. E. Jepson, Mrs. A. Bentham. Mr. Seabrook has written to us once more asking us to bring the claims of the organisation forward as strongly as we can. We stated the position and the argument fully on page 434 of our issue of October 2nd, but we mention his present request in the hope that other important readers of these pages will adopt the excellent example just set by Mr. Brook. This is the month of the Ball—do not let us delay our acts of generosity until after the Ball is over.

I.E.E. (South Midland Centre)

The South Midland Centre of the Institution of Electrical Engineers is to hold its annual dinner at the Grand Hotel (Grosvenor Room), Birmingham, on Friday, November 27th, 1936. The dinner is to commence at 7 p.m., being preceded by a reception from 6.30 to 6.55 p.m. A reunion will follow. Applications for tickets, which are 12s. 6d. each, should be made to the hon. secretary, Mr. H. Hooper, 65, New Street, Birmingham, not later than November 14th.

Connecting-up Heaters

The "Vidor" heater illustrated on page 473 of our issue of October 9th was referred to in the caption as a "bathroom heater." The method of connection shown (a lamp-holder adaptor) was not, however, applicable to this service, as this would not comply with I.E.E. Regulation No. 1002. The correct description is "universal model," the bathroom model being white enamelled. Vidor, Ltd., informs us that the following label is attached to each radiator sent out: "This appliance is fitted with 3-core flex. A bayonet cap adaptor is fitted for the convenience of those using it from a lighting circuit. When it is used from a power circuit, cut off adaptor and fit a suitable plug. When used in bathroom, garage, or damp situations, a three pin earthed plug should be used. The white core of the flex which has been cut back is connected to the earth pin."

Appointments Vacant

Junior showroom attendant (female) for Hammersmith Electricity Department.

Technical assistant in the Mains Department for Ilford Corporation.

Assistant to the electrical engineer for Hitchin U.D.C.

Electrical engineer and manager for Hampstead Borough Council.

Electric meter and instrument tester at the R.A.F. Establishment, Dhibban, Iraq.

Assistants III and III and Junior scientific officer in the Admiralty Technical Pool.

Consumers' engineer for the Exe Valley Electricity Co.

Control engineer for Croydon Electricity Department.

Clerk for Battersea Electricity Department.

Telegraph inspector for the Gold Coast Posts and Telegraphs Department.

Mechanical or electrical engineers for the R.A.O.C.

Examiners in the w/t and instrument sections, and electrical engineering drawing office assistants for the Air Ministry.

(See our classified advertisements.)

Fatality

The death of Mr. Frank Norris Willis Kenwright, aged twenty-nine, of Carlton Avenue, Wallington, an electrical engineer employed by the Croydon Corporation, was investigated at an inquest, held on Tuesday last at the Bandon Hill Cemetery Chapel, by Dr. W. J. Lord, the Coroner for East Surrey. Evidence was given that Mr. Kenwright was an experienced electrical engineer. On Saturday, October 31st, he went into the loft of his home to alter some wiring for the purpose of installing a bathroom radiator. Frayed insulation on a wire caused a metal tube to become alive, and he received a fatal electric shock. The Coroner recorded a verdict of accidental death.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

EPIC fire.

Wall paper stripper

INVERCONE weatherproof fittings

Readers should enclose stamped addressed envelopes when making their enquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. T. Welch, assistant station superintendent with the Fulham Borough Council, has been recommended by the Staff Committee for the appointment of assistant maintenance engineer at the new power station at a salary of £558 per annum.

Mr. W. H. Gardiner has joined the staff of Belling & Co., Ltd., as sales engineer for Scotland. Mr. Gardiner was apprenticed to Messrs. Fraser & Borthwick, Glasgow, but during his apprenticeship period he entered the sales side of the business and completed ten years' experience as general buyer for the company's entire business, covering wholesaling, contracting and public works. From there he went to William Brown & Co. (Engineers), Ltd., with whom he acted first as traveller and afterwards as sales manager, covering the whole of Scotland, the length of his term there being twelve years. For the last four and a half years Mr. Gardiner has acted as branch manager for Glasgow and the Western district of Scotland and part of the North of Scotland for Messrs. Wood & Cairns, Ltd.

Mr. W. H. Gardiner

Mr. R. R. C. Hunt has taken over the technical management of the Wego Condenser Co., Ltd., Perivale, Middlesex, and retains his association with Messrs. H. C. Daly.

Mr. R. H. Rawll, M.I.E.E., M.I.Mech.E., hon. assistant secretary of the South Midland Centre of the Institution of Electrical Engineers, has removed to 125, Wentworth Road, Harborne, Birmingham, 17.

Mr. J. A. Fraser has resigned his position as commercial manager of Carron Company's electrical cooking and heating department to take up an appointment with the English Electric Co. as sales manager of the electric domestic heating and cooking section.

Mr. T. F. Wall, D.Sc., D.Eng., M.I.E.E., A.M.Inst.C.E., the author of the article on "Training Electrical Engineers," on page 633, is lecturer-in-charge of the Electrical Engineering Department of the University of Sheffield. During the past few years he has been particularly occupied in the development of magnetic methods for the non-destructive testing of materials with special reference to the design and construction of an electro-magnetic apparatus for testing *in situ* the mechanical conditions of colliery and other wire ropes. The investigations have also included the application of magneto-striction phenomena to the measurement of Young's modulus for iron, steel, cobalt, nickel, and copper wires; the measurement of the speed of travel of surges of stress in steel wires, resulting in new methods for measuring Young's modulus and also for determining the state of mechanical deterioration of worn or distorted wires; and ballistic methods for measuring the work-hardening of steel wires.

He has also carried out a large number of investigations on the conditions of stability of large generators operating in parallel on the grid; and on the economical control of the speed and power factor of three-phase induction motors with special reference to the operation of rolling mills and winding plant.

Mr. E. Braathen, A.M.I.E.E., switchgear engineer to the Hackney Borough Council and senior lecturer in electrical engineering and thermodynamics at the L.C.C. Polytechnic, E.5, has been appointed by the Hackney Borough Council as technical assistant to the electricity undertaking. Entering the profession twenty years ago as a first class honours student of the City and Guilds Institute and silver medalist, Mr. Braathen has spent most of his time with the Stepney and Hackney undertakings.

Mr. B. M. Bellasis has, on medical advice, tendered his resignation as general manager of the Empire Exhibition at Johannesburg. *The Times* reports that the Executive Committee has accepted his resignation with regret and has paid tribute to his valuable services.

Mr. A. Blake, for forty years electrical engineer to the Fareham Urban District Council, who has retired, has been presented by his colleagues with a smoking set. Mr. Blake became engineer in 1896, when the Council acquired the undertaking of the Fareham Electric Light Co., of which he was secretary and manager.

Mr. W. J. Brown, B.Sc., A.M.I.E.E., has recently resigned from Electrical and Musical Industries, Ltd., to take the appointment of director of engineering with Philco Radio & Television Corporation of Great Britain, Ltd. After leaving the Manchester University where he took a first class honours degree, he spent a short time at the National Physical Laboratory and then joined the Research Department of the Metropolitan-Vickers Electrical Co., Ltd. At the inception of broadcasting in England he assumed technical control of the Metropolitan-Vickers broadcasting station 2ZY, and later took charge of the company's radio research section.

[Elliott & Fry

Mr. W. J. Brown

In 1925 Mr. Brown established the first reception and re-transmission in England of short-wave transatlantic broadcasts from Westinghouse station KDKA on 100 metres, and during the following year was engaged in further pioneer work in establishing methods of communication at a wavelength of 2 metres, originating many patents in this field. At the same time he was engaged in the development and experimental construction of high power, steel tank, and mercury arc rectifiers for electric railway supply. In 1929, upon the entry of the Gramophone Co., Ltd., into the radio industry, he joined that company and equipped its factories at Hayes and Dagenham with test equipment. In recent years, as the chief designs engineer of that company, he has been responsible for many successful designs. He read a paper before the Institution of Electrical Engineers in May, 1935, on the "High Fidelity Radiogramophone," which was awarded a special premium.

Mr. W. K. Fleming, A.M.I.E.E., burgh electrical engineer and manager of Rothesay, has been recommended by the Scarborough Electricity Committee for appointment as borough electrical engineer and manager at Scarborough.

The Duke of Kent paid a visit to Henley's Gravesend works on Friday last. The above photograph taken on the occasion shows (from left to right) Sir Montague Hughman (chairman of Henley's), the Duke, Mr. W. F. Bishop (director and general manager), Mr. R. O. Wright (late manager, Gravesend works), Mr. E. E. Judge (recently appointed works manager), and Dr. P. Dunsheath (chief engineer)

Mr. O. I. Butler, B.Sc. (Hons.), author of the article on "Cattle and Electric Shock" (page 630), is an assistant lecturer in the Department of Electrical Engineering at the University of Liverpool. He received his technical education at the University College, Cardiff, and afterwards pursued the post-graduate apprenticeship course of the Metropolitan-Vickers Electrical Co., Ltd., and was appointed to the general engineering staff of that company. He is a member of the Association of Mining Electrical Engineers, and was awarded a premium in 1935 for a paper on "Electric Locomotives in Mines," delivered at Manchester to the Students' Section of the I.E.E. He is the assistant secretary of the Mersey and North Wales (Liverpool) Centre of the I.E.E.

Obituary

Mr. W. J. Blenheim.—The death occurred in New York on October 29th, at the age of 58 years, of Mr. William J. Blenheim, traffic manager of the cable system of the Western Union Telegraph Co. He was born at Egham, Surrey, and spent his early years in telephone, fire alarm, and electric light installation work. He graduated electrically at Liverpool. Later he was engaged in the laboratory of Sir Oliver Lodge while the latter was conducting some if his early radio experimental work. Subsequently he became principal research engineer to the Lodge-Muirhead Wireless Telegraph Co., and was responsible for contracts for wireless systems established in the East and elsewhere for the British Government. After several years' service with the Direct United States Cable Co. he joined the Western Union Company in 1910 in London; in 1915 he became its cable traffic manager and was transferred in that capacity to New York in 1917.

Mr. Thomas Worley Stewart, a former chief draughtsman in the service of C. A. Parsons & Co., Ltd., Newcastle-on-Tyne, has died, aged sixty-four. He was with Messrs. Parsons for eighteen years, but later began on his own account.

Sir Newton Moore.—Major-General the Hon. Sir Newton J. Moore, K.C.M.G., V.D., died on October 28th in a London nursing home after an operation, aged sixty-six years. After a great public career in Australia, he came to London as Agent-General for Western Australia and devoted his attention to economic and industrial affairs, especially Imperial economic relations. He was a director of many companies overseas, and several in this country, including the General Electric Co., Ltd.

Dr. Fritz Eisler, a famous X-ray specialist, died in Vienna recently at the age of fifty-three. His death was due to his health having suffered from the effects of his experiments.

Mr. J. Begg.—The death occurred on October 23rd, at his home in Paisley, of Mr. James Begg, a director of Glenfield & Kennedy, Ltd. Mr. Begg was over seventy years of age.

Mr. C. G. Howard.—The death occurred recently at Guildford of Mr. Claude G. Howard, manager and director of Bowden & Higlett, Ltd., electrical contractors of Guildford.

Will.—Mr. Frank Arnold Darrah, a director of Baxendale & Co., Ltd., left £70,085, with net personalty £61,406. He left £1,000 to Baxendale & Co.'s employés' benefit fund.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

J. Warsop & Co., Ltd.—Private company. Registered October 26th. Capital, £1,500. Objects: To acquire the business of an electrical engineer now carried on by J. L. Warsop at Worplesdon Road, Guildford. The directors are: J. L. Warsop (managing director), "Mulgoa," Worplesdon Road, Guildford; and E. H. Mackie, "Newlands," Puttenham, Surrey. Registered office: "Mulgoa," Worplesdon Road, Guildford.

F. S. Taieb, Ltd.—Private company. Registered October 22nd. Capital, £1,000. Objects: To acquire the business of a radio dealer now carried on by F. S. Taieb at Honey Lane, Maidenhead Street, Hertford, and at 2, Sun Street, Hitchin, Herts. The subscribers are: F. S. Taieb and Mrs. E. B. Taieb, both of Ivy Cottage, Balfour Street, Hertford. Secretary: G. R. Humphrey. Registered office: Honey Lane, Maidenhead Street, Hertford.

Philradio Electric, Ltd.—Private company. Registered October 23rd. Capital, £2,000. Objects: To carry on the business of manufacturers, sellers, importers and exporters of and dealers in wireless, telephone and telegraph apparatus, instruments, parts, accessories and goods, wireless, electrical, mechanical and general engineers, &c. H. Phillips, 2, Mather Avenue, Prestwich, Manchester, is permanent director and chairman. Registered office: 24, Cavendish Street, All Saints, Manchester.

James Stott & Son (Electrical), Ltd.—Private company. Registered October 23rd. Capital, £1,000. Objects: To carry on the business of electricians, mechanical engineers and manufacturers, manufacturers of and dealers in electrical apparatus and fittings, wireless receivers, &c. The permanent directors are: J. Stott, 49, Lance Lane, Wavertree, Liverpool; and A. A. Stott, 81, Church Road, Woolton, Liverpool. Registered office: 35, Bold Street, Liverpool.

F. D. Sims, Ltd.—Private company. Registered October 29th. Capital, £6,000. Objects: To carry on the business of manufacturers of and dealers in electric wires and cables of all descriptions, belts, cords, conductors, turbines, boilers, engines, dynamos, motors and mechanical and electrical machinery, &c. The subscribers are: F. W. Barnes, 6, Albemarle Road, Woodthorpe, Notts; and F. D. Sims, 11, Woodthorpe Avenue, Woodthorpe. Solicitors: Acton, Marriott & Simpson, King Street, Nottingham.

Armstrong Amplifiers, Ltd.—Private company. Registered October 29th. Capital, £100. Objects: To carry on the business of manufacturers of amplifiers, microphones and all kinds of instruments and apparatus for the enhancement of sound and acoustics generally, &c. The directors are: C. C. Jackson (permanent managing director), 100, King's Road, Camden Town, N.W.1; M. R. Fitzwilliam, 20, New Steine, Brighton; and Miss R. Law, 63, London Road, Forest Hill, S.E.23.

Hackney Radio Supplies, Ltd.—Private company. Registered October 30th. Capital, £100. Objects: To carry on the business of radio engineers, gramophone manufacturers, dealers in radio components and accessories, &c. The subscribers are: D. Aarons, 152, Evelyn Court, Amhurst Road, Hackney, E.8; and O. T. Jordan, Kentmere House, Palmerston Road, Plumstead, S.E.18. D. Aarons is the first director. Secretary: D. Aarons. Registered office: 210, Mare Street, Hackney, E.8.

Brown-Bernard Battery Co., Ltd.—Private company. Registered October 30th. Capital, £500. Objects: To acquire any invention relating to the production, treatment, storage, application, distribution and use of electricity, and in particular to acquire from F. L. R. Brown the benefit of certain existing inventions relating to electrical accumulators, &c. The first directors are F. L. R. Brown, S. J. Bernard and L. W. Robson. Solicitors: Pennington & Son, 64, Lincoln's Inn Fields, W.C.2.

Read-o-Light, Ltd.—Private company. Registered October 30th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in lamp shades of all kinds, &c. The subscribers are: R. J. Reader, 72, Bethel Road, Welling, Kent; and J. N. Somers, 205, The Broadway, N.W.2. R. J. Reader is first director. Registered office: 70a, Basinghall Street, E.C.2.

N. A. Constable, Ltd.—Private company. Registered October 31st. Capital, £1,000. Objects: To acquire the business of an electrical engineer now carried on by N. A. Constable at 47, Lower Mosley Street, Manchester. The directors are: G. Copley-Smith, "Kilmorey," Whitehall Road, Brooklands; N. A. Constable, 149, Lloyd Street, Chorlton-cum-Medlock, Manchester; and C. J. McEwen, 6, Windsor Avenue, Heaton Moor, Stockport. Solicitors: Herbert Scott Holmes, Bexley Square, Salford.

John C. Enright & Co., Ltd.—Private company. Registered October 31st. Capital, £1,000. Objects: To carry on the business of electrical engineers and contractors, &c. The directors are: J. C. Enright, 21, Green Lane, Cookridge, Leeds; and A. E. Clay, 42, Armley Grange Drive, Leeds, 12. Secretary: W. A. Holmes.

St. Mary's Radio, Ltd.—Private company. Registered October 28th. Capital, £5,000. Objects: To acquire the business of a wireless and electrical dealer carried on by H. A. Lee at 8, Onslow Road, Southampton, and 53a, London Road, North End, Portsmouth. The directors are: H. A. Lee and Mrs. Elsie W. Lee, both of 34, Newlands Avenue, Southampton. Registered office: 8, Onslow Road, Southampton.

Whiteway Lighting, Ltd.—Private company. Registered October 30th. Capital, £2,000. Objects: To acquire British Patent No. 372111 of May, 1931, in respect of a system of electrical lighting of pictures and tapestries and to carry on the business of lighting specialists, &c. The directors are: Com. Reginald W. J. White, R.N. (retd.), Wintney House, Hartley Wintney, Hants; and C. F. J. D. Webster, Hurst Grange, near Twyford, Berks. Registered office: 22, Bruton Street, W.1.

Returns of Electrical Companies

Anchor Cable Co., Ltd.—Capital, £250,000 in £10 shares. Return dated July 2nd, 1936. 21,334 shares taken up. £79,340 paid on 7,934 shares. £134,000 considered as paid on 13,400 shares. Mortgages and charges, nil.

Oliver Pell Control, Ltd.—Charge on 50, Bloomfield Road, Plumstead, S.E.18, and land adjoining, dated October 13th, 1936, to secure £1,100. Holders: Kent Reliance Permanent Benefit Building Society, 3, Thomas Street, Woolwich, S.E.18.

Superfluxes, Ltd.—R. H. Stevens, C.A., of 37, Walbrook, E.C., was appointed receiver and manager on October 27th, 1936, under powers contained in instrument dated July 13th, 1936.

Ormiston's Alumina, Ltd.—J. L. Harper, C.A., of 39, Great Tower Street, E.C., was appointed receiver and manager on October 22nd, 1936, under powers contained in debenture dated May 1st, 1936.

Stearn Electric Co., Ltd.—Capital, £4,000 in 4,000 shares of £1. Return dated August 21st, 1936. All shares taken up. £2 paid. £3,998 considered as paid. Mortgages and charges, £18,200.

T. B. T. Electric Co., Ltd.—Capital, £2,000 in 400 shares of £5. Return dated June 8th, 1936. 200 shares taken up. £1,000 paid. Mortgages and charges, nil.

Ultra Electric, Ltd.—Capital, £200,000 in £1 shares. Return dated July 30th, 1936. 180,000 shares taken up. £48,000 paid. £132,000 considered as paid. Mortgages and charges, £85,000.

J. T. C., Ltd.—Capital, £20,000 in £1 shares. Return dated June 8th, 1936. 15,000 shares taken up. £15,000 paid. Mortgages and charges, nil.

Contraflo Engineering Co., Ltd.—Capital, £43,725 in 53,000 shares of 16s. 6d. each. Return dated June 5th, 1936. All shares taken up. £43,725 paid.

Radio-Aid, Ltd.—Capital, £100 in 400 ordinary shares of 5s. Return dated July 14th, 1936. 160 shares taken up. £40 paid. Mortgages and charges, nil.

Howard Butler, Ltd.—Capital, £5,000 in £1 shares. Return dated July 22nd, 1936. 3,500 shares taken up. £3,500 paid. Mortgages and charges nil.

Child's Electrical Stores, Ltd.—Capital, £1,000 in £1 shares. Return dated June 17th, 1936. All shares taken up. £2 paid, £998 considered as paid. Mortgages and charges: £502 15s.

Lewis Thomas & Sons, Ltd.—Mortgage on properties in Aberystwyth, dated October 8th, 1936, to secure £4,401. Holder: J. D. Williams, "Boulevard," North Parade, Aberystwyth.

P. H. Jackson & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 10th, 1936. 301 shares taken up. £301 paid. Mortgages and charges nil.

Hulton & Hinchliffe, Ltd.—Capital, £500 in £1 shares. Return dated July 9th, 1935 (filed May 26th, 1936). All shares taken up. £500 paid. Mortgages and charges, nil

A. Melville Sidley, Ltd.—Capital, £1,000 in £1 shares. Return dated June 3rd, 1936. 676 shares taken up. £127 paid, £349 considered as paid. Mortgages and charges nil.

V. C. Bond & Sons, Ltd.—Capital, £5,000 in £1 shares. Return dated June 4th, 1936. 4,002 shares taken up. £4,002 considered as paid. Mortgages and charges, nil.

Parsons & Hodges, Ltd.—Satisfaction to the extent of £2,000 on October 13th, 1936, of mortgage dated November 8th, 1933, and registered November 16th, 1933.

W. E. Chappell, Ltd.—Capital, £1,000 in £1 shares. Return dated June 19th, 1936. 650 shares taken up. £2 paid. £648 considered as paid. Mortgages and charges, nil.

Taylor, Whiting & Taylor, Ltd.—Capital, £4,000 in £1 shares. Return dated July 23rd, 1936. 3,962 shares taken up. £2 paid. £3,960 considered as paid. Mortgages and charges, nil.

Willmott, Son & Phillips, Ltd.—Capital, £1,000 in £1 shares. Return dated July 31st, 1936. 501 shares taken up. £501 paid. Mortgages and charges, nil.

Electric Light Wood Fittings Co., Ltd.—C. H. Brand, of Denham Studios, Denham, Bucks, ceased to act as receiver and manager on October 14th, 1936.

A. J. Shrosbery & Co., Ltd.—Satisfaction in full on October 3rd, 1936, of 2nd debenture dated February 15th, 1936, and registered February 18th, 1936, securing £300.

H. A. Birch & Co., Ltd.—Issue on October 1st, 1936, of £200 debentures, part of a series already registered.

Readylock, Ltd.—Issue on August 4th, 1936, of £75 debentures, part of a series already registered.

City Notes

Ferranti, Ltd., held their annual meeting on October 28th, when Mr. V. Z. Ferranti (chairman and managing director), who presided, said that their turnover had again increased and in spite of the continuance of restrictions upon international trade they could report a considerable rise in export trade. Investments in subsidiary companies and sundry investments remained the same as in the preceding year; the prospects of their subsidiaries were brighter and both should show improved results in the current year. Regarding the outlook for the current year their range of voltage-regulating apparatus had been extended to meet the growing requirements of the supply industry, and recent orders for large power transformers included two 60,000-kVA units for the Central Electricity Board. They had also introduced additional radiant fires and other electrical apparatus with satisfactory results. These increased sales, together with Government contracts in hand, represented an improvement over the previous year, and ensured, in spite of severe competition in the radio industry, an increased output.

Electric & Musical Industries, Ltd., reports that receipts from dividends by the Gramophone Co. and the Columbia Graphophone Co., the two operating concerns, for the year ended September 30th last amounted to £254,446, as compared with £445,603 in the preceding year, when £144,544 was added from the profit on sale of investments. The total income was £366,498, as against £681,588, to which is added £197,558 brought in, making £564,056. The ordinary dividend is maintained at 10 per cent., but last year a bonus of 2½ per cent. was also distributed. The amount carried forward is £201,872. The report states that owing to the incidence of losses in previous years the amount set aside for income-tax by the operating concerns in former years has proved to be in excess of requirements. A part of the surplus has been applied in writing down assets in certain European countries where disturbed conditions exist. The balance, together with £20,000 from revenue, is adequate provision for income-tax.

B. & F. Carter & Co., Ltd.—Particulars of this company were published on Monday last for information only. It has been formed with an authorised and issued capital of £60,000 divided into ordinary shares of 2s. each, to acquire the business of B. & F. Carter & Co., Ltd., established in 1919, which manufactures high-speed machines, including electric cable, asbestos, braiding, plaiting, winding and twisting, and other types of machines. New works have been acquired at Bolton. The total net assets amount to £63,566 and exceed the total nominal capital by over £3500.

The British Oxygen Co., Ltd.—In declaring an interim ordinary dividend of 7 per cent., less tax, the directors state that the results for the year to date would justify an increase in the interim distribution, but they have decided to defer the question of increased distribution or capital bonus until the final results for the year are available. The interim dividend for 1935 was 7 per cent., which was followed by a capital bonus of 28-4/7th per cent., and a final payment of 8 per cent.

Increases of Capital.—The following companies have recently increased their registered capital to the extent shown:—Smith & Ansell, Ltd., from £7,000 to £12,000; J. & F. Stone Lighting & Radio, Ltd., from £300,000 to £600,000; Parmiter, Hope & Sugden, Ltd., from £25,000 to £40,000; Lincolnshire & Central Electric Supply Co., Ltd., from £500,000 to £750,000; and Mid-Lincolnshire Electric Supply Co., Ltd., from £450,000 to £550,000.

Warner's Radio & Electric, Ltd.—At a meeting which was to be held on Wednesday last proposals were to be considered for increasing the capital of the company by the creation of 80,000 10s. preference and 1,100,000 1s. ordinary shares.

Companies to be Struck off the Register.—The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—Commercial Radio Co., Ltd.; Electro-Thermic Development Co., Ltd.; Enradic Electric Co., Ltd.; Red Star Radio, Ltd.; Superservices (Radio), Ltd.

The Bengal Telephone Corporation reports a profit to June 30th, after allocating Rs.9,61,876 to depreciation, of Rs.10,79,364, as compared with Rs.10,42,639 in the preceding year. The ordinary dividend is maintained at 8 per cent., tax free, and Rs.4,75,872 is carried forward.

The Craigpark Electric Cable Co. states that although the results for the first half of the financial year show considerable improvement, the board has decided to postpone payment of the preference dividend due on November 11th until the full accounts are available.

Drake & Gorham, Ltd., reports a net profit for the year ended June 30th of £7,672, as compared with £592 in the previous year. It is proposed to place £6,000 to reserve and to carry forward £2,264, against £592 brought in. During the year £2,790 of 5½ per cent. debenture stock was redeemed.

The Edison Swan Electric Co. is holding an extraordinary meeting on November 18th to consider a resolution that the company be converted into a private company and that the articles of association be amended.

The Atlas Electric & General Trust, Ltd., is paying an interim dividend of 3½ per cent. on the 7 per cent. cumulative preference shares.

The Kalgoorlie Electric Power & Lighting Corporation, Ltd., has declared an interim dividend of 3 per cent., actual, less tax (same).

The Anglo-Portuguese Telephone Co. has announced an interim dividend of 3 per cent. on the ordinary stock (unchanged).

Meters, Ltd., is maintaining its interim ordinary dividend at 2½ per cent., actual, less tax.

Stocks and Shares

TUESDAY EVENING.

THE principal feature of the present week has been the outbreak of one of the periodical, and usually reckless, rubber booms, which produce a vast excitement and a fair amount of business, but which too often end in disappointment, owing to the failure of prices to maintain the advanced levels. Mention of it here is rendered necessary by the fact that such a rush of business to any particular market has the effect of diverting attention from other, and more staidly moving, stocks and shares, some of which are, indeed, sold by the speculator who is eager to take a hand in whatever may be the popular market of the moment.

Another influence of importance has been the Presidential election in the United States, the influence of which in the London market was to cause a good deal of hesitation and to restrict, for the time being, any activity of dealing except in a few specialised stocks. With the declaration of the result American business is expected to have a chance of going ahead unhampered by the political considerations which for some months past have hung over the American markets.

Throughout the Stock Exchange markets as a whole the sentiment continues hopeful of a further advance in prices under the stimulus of investment of money for which it becomes increasingly difficult to find profitable employment. Not many years ago the knowledge of there being such a line as, for example, 800,000 Edmundson's ordinary available for purchasers at 4/6s. per share, would have been regarded as something exceptional, whereas to-day it is of so little account that half a million of the shares were taken at the price named within a few days. Of the disposal of the remainder within a comparatively short time no doubt can be entertained.

L.P.T.B. "C" Stock

Publication of the London Passenger Transport Board's informative report fell heavily on the market, the obvious reaction being a relapse in the price of the "C" stock, the vulnerable member of the Board's issues. The fall extended at first to 5 points, taking the quotation to 97, the lowest price touched this year, and more than a dozen points below the highest. A little buying rallied the price to 98. Reasons for the decline emerge clearly from the report. The 4 per cent. interest which "C" stockholders receive for the year proves to have been covered by available revenue with only a small margin to spare. Other disquieting factors are the million pounds rise in working expenses and the disappointingly small increase of less than 2½ per cent. in traffic receipts—evidence of deceleration in the rate of traffic expansion. On the credit side must be placed a modest increase in the year's net revenue, and, looking ahead, the benefits which should accrue in Coronation year. Prospects of a rise in the "C" stock dividend to the standard rate seem, however, sufficiently dim to keep the price of the stock around par for the time being. The Tilling Company's offer of the stock to its shareholders has produced a certain amount of selling on behalf of the latter, and so aggravated the weak condition of the market.

Tilling's Offer

Shareholders in Thomas Tilling are receiving another "melon." This time it takes the shape of a distribution, at a profitable figure, of part of the company's £1,500,000 holding

of L.P.T.B. "C" stock. The offer is of £1 of the latter stock for every ten Tilling ordinary shares held at a price 6 points below the present market quotation. It would be an ungenerous shareholder who complained that the rights would have been worth more had they accrued a week or two earlier.

The Thomas Tilling company received its allotment of "C" stock in 1934 as part consideration for the transfer of a section of its business to the Transport Board. After the distribution now proposed some £1,200,000 stock will remain in the portfolio. Other distributions made comparatively recently to Tilling's ordinary shareholders were a capital bonus of 100 per cent. in 1935 and another of 25 per cent. early this year.

Electricity Supply Issues

Dealings began, at the end of last week, in a £300,000 block of Midland Electric Corporation 3½ per cent. debenture stock. The issue was privately placed, and became available in the market at a price round about 102, free of stamp duty and fee. A similar amount of the stock has already been issued, and a further £400,000 is authorised. The yield on a purchase at 102 works out at approximately three guineas per cent.; the stock constitutes one of the best-secured investments of its kind, interest being covered nearly nine times by last year's available profits. Redemption dates are between 1965 and 1973.

Little business is being transacted in home electricity supply ordinary shares. North Metropolitans dropped 1/6 to 56s. 3d. and County of Londons lost 1s. to 54s. The latter movement may be connected with local agitation in Wandsworth for a reduction in charges to consumers. Otherwise, price-changes are practically non-existent. In the foreign group, Perak Hydros picked up to 31s. 6d., but Palestine "A" shares, at 52s. 6d., show 1s. loss. Tokyo 6 per cent. bonds advanced from 83 to 84. Atlas Electric improved to 8s. 3d.

Electrical Equipment Shares

Recently active shares in the electrical equipment market are noticeably quieter, but liveliness has quickened, to some extent, in other directions, noticeably in the case of Crompton Parkinsons, which rose from 4⅛ to nearly 90s. before reacting to 4⅜. Bullish interest in the coming report is responsible. British Insulated, after slipping 1/8 of the previous week's big gain, recovered to 6 1/16; other leaders in the cables group are generally steady, London Electric Wires showing renewed strength at 39s. Johnson & Phillips are dull, by exception, at 50s. Ever Ready are well maintained at 30s. 6d., ex dividend, and Young Accumulators are good at 3s. on rumours of a pending scrip distribution. Lancashire Dynamo and Crypto are in good demand at 3⅜, and General Electrics returned to favour with a rise of 3s. to 91s. Automatic Telephone and Electric (known, until recently, as International Automatic Telephone) are quoted at 47s. 3d. Telephone Manufacturing shed a few pence to 10s. 3d., ex dividend. Reyrolles reacted from 80s. to 78s., and Enfield Rolling Mills fell 1s. to 19s. 6d. The recently introduced "A" shares of Laurence, Scott and Electromotors weakened to 10s. 3d.

Telegraph Construction

Telegraph Construction and Maintenance £1 ordinary shares are being quietly absorbed on hopes of a possible re-entry of the company, at the end of this year, into the dividend-paying list. The present price of 35s. compares with 25s. earlier this year. Largely as a result of a heavy decline during the depression years in the submarine cable side of the business, ordinary shareholders have received nothing since 7½ per cent. was paid in 1930. The 1935 accounts, however, showed a small surplus of profits, and, at the annual meeting, a reasonably hopeful view was taken of prospects in the year now current. The submarine cable manufacturing interests were merged a year ago with those of Siemens Bros. on a fifty-fifty basis, with a considerable gain in economy and efficiency. The company's land cable business, notably where radio relay cables are concerned, should now be repaying well the extra attention which it received owing to the falling-off in other directions. The next accounts, due in February, are expected to show sufficient all-round recovery raising profits to within striking distance, at least, of a resumption of ordinary dividends.

Cable and Wireless stocks are quiet and the prices show no quotable change on the week. The starting-up of television has done nothing to infuse energy in the shares of the companies concerned with this latest development.

Miscellaneous Matters

The gilt-edged market remains in undecided mood, with a slight tendency to weakness in Government stock-prices. A contrast is again provided by Central Electricity Board issues, further appreciable gains being recorded in the two 5 per cent. stocks, the 1950/1970 issue being up to 120 and the 1955/1975 issue to 121. Investment is insatiable for sound stocks and shares. Our price-lists give the middle quotations published in the daily Stock Exchange Official List. Were these to be tested by actual business, the result would be, in the majority of cases, that sales could be effected at these middle prices, whereas the prospective purchaser might find difficulty in fulfilling his requirements except at prices decidedly higher than those quoted. This applies more particularly, of course, to fixed-interest issues.

Share List of Electrical Companies

		Nom.	Dividend. Previous.	Dividend. Last.	Price. Nov. 3.	Rise or Fall.	Yield. p.c. £ s. d.
HOME ELECTRICITY COMPANIES.							
Bournemouth and Poole		1	15	15	77/6	—	3 17 5
City of London		1	7½	7½	37/6	—	4 0 0
Clyde Valley		1	7	8	47/6	—	3 7 7
County of London		1	10½	10½	54/-	-1/-	3 17 9
Edmundson's 7% Pref.		1	7	7	36/-	—	3 17 9
Do. Ord.		1	8	8	46/-	—	3 9 7
Elec. Dis. Yorkshire		1	9	9	49/-	—	3 15 6
Elec. Fin. and Securities		1	12½	12½	3½	—	4 0 0
Elec. Supply Corporation		1	11	11	59/6	—	3 13 10
Lancs Light and Power		1	7½	7½	38/6	—	3 18 0
Lond. Assoc. Electric		1	—	7	35/-	—	4 0 0
London Electric		1	7	8	39/6	—	4 1 1
London Power Deb. Red.		Stock	5	5	107½	—	4 13 0
Metropolitan		1	10	10	51/-	—	3 18 8
Midland Counties		1	7	7½	41/-	—	3 13 2
Mid. Elec. Power		1	8	8	45/-	—	3 11 1
North Eastern Electric Ordinary		1	6	6	34/6	—	3 9 7
Do. 7% Pref.		1	7	7	36/6	—	3 16 9
Northampton		1	10	10	51/3	—	3 18 2
Notting Hill 6% Pref.		10	6	6	14½	—	4 4 3
North Met. Elec. Ordinary		1	10	10	56/3	-⅛	3 11 1
Do. do. 6% Pref.		1	6	6	32/-	—	3 15 0
Scottish Power		1	8	8	41/-	—	3 18 2
South London		1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.		1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.		1	8	8	44/-	—	3 12 9
PUBLIC BOARDS.							
Central Electricity, 1950–70		Stock	5	5	120	+1½	4 3 5
Do. 1955–75		„	5	5	121	+1	4 2 8
Do. 1951–73		„	4½	4½	114	—	3 19 0
Do. 1963–93		„	—	3½	104xd.	+¼	3 7 4
London Elec. Trans. Gtd.		„	—	2½	96	—	2 12 1
London & Home Counties, 1955–75		„	4½	4½	115	—	3 18 3
London Passenger Transport, A		„	—	4½	126½	—	3 11 2
Do. do. B		„	—	5	129½	+½	3 17 3
Do. do. C		„	3½	4	98	-4	4 1 8
West Midlands Joint Elec. 1948–68		„	—	5	116½	+1	4 5 10
TELEGRAPH AND TELEPHONE.							
American Tel. & Tel.		$100	9	9	183½	+1	4 18 1
Anglo-Am. Tel. Pref.		Stock	6	6	128½	—	4 13 5
Do. Def.		„	1½	1½	31	—	4 16 9
Cable & Wireless 5½% Pref.		„	4½	5½	103½	—	5 6 3
Do. A. 7½% Ord.		„	Nil	Nil	20½	—	—
Do. B. Ord.		„	Nil	Nil	6½	—	—
Globe Tel. & Tel. Ord.		10	3½*	4½*	14½	+½	3 3 4
Do. Do. Pref.		10	6	6	14½	—	4 2 9
Great Northern Tel.		10	20	20	46	—	4 17 0
Marconi-Marine		1	10	7½	36/3	—	4 2 9
Oriental Telephone Ord.		1	12*	12*	3 3/16	—	3 15 6
HOME AND FOREIGN TRAMS, ETC.							
Anglo-Arg. Trams First Pref.		5	Nil	Nil	8/3	-9d.	—
Do. do. 2nd Pref.		5	Nil	Nil	5/-	—	—
Do. do. 5% Deb.		Stock	Nil	Nil	20½	-4	—
British Electric Traction Df. Ord.		„	5	5	1075	+25	—
Do. do. Pref. Ord.		„	8	8	181½	+1	4 8 2
Brazil Traction		100	—	30 cts.	17½	+1½	—
Brit. Columbia Elec. Rly. Pce.		Stock	5	5	104½	—	4 15 8
Mexican Light Common		100	Nil	Nil	3½	+½	—
Do. 1st Bonds		$500	5	5	50	—	—
Victoria Falls Ord.		1	20	12	76/3	+6d.	3 3 0
West Riding		1	5	6½	50/-	—	2 12 9
MANUFACTURING COMPANIES.							
Aron Electricity Ord.		1	10	15	62/6	—	4 16 1
Assoc. Elec. Ord.		1	6	8	55/-	—	2 18 2
Do. Pref.		1	8	8	39/6	—	4 1 0
Babcock & Wilcox		1	8	8	51/6	—	3 3 4
British Aluminium Ord.		1	7½	7½	44/-	+1/-	3 7 6
British Insulated Ord.		1	15	20	6 1/16	+1/16	3 5 9
Brush Ord.		Stock	Nil	Nil	43½	—	—
Callender's		1	15	15	4 3/16	—	3 5 8
Do. 6½% Pref.		1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/-	—	12½	4½		+½	—
Do. 8% Pref.		1	8	8	2	—	4 0 0
Electric Construction		1	3½	7	40/-	—	3 10 0
Enfield Cable Ord.		1	25	25	5 1/16	—	4 7 0
English Electric		1	Nil	Nil	26/-	+6d.	—
Do. Do. Pref.		1	Nil	Nil	28/-	—	—
Ericsson Tel.	5/-	24	20*	58/9	—	1 14 0
Ever Ready	5/-	35	35	30/6xd.	+1/-	5 14 8
Ferranti Pref.		1	7	7	28/9	—	4 17 5
G.E.C. Pref.		1	6½	6½	35/-	—	3 14 4
Do. Ord		1	10	15	94/-	+3/-	3 3 10
Henleys		1	30	30	8½	-½	3 10 7
Do. 4½% Pref.		5	4	4½	5½	—	3 18 3
India-Rubber Preferred		1	—	5½	1½	—	4 17 9
Johnson & Phillips		1	7½	10	50/-	-1/-	4 0 0
Lancashire Dynamo		1	5	10	3½	+⅜	2 19 2
Siemens Ord.		1	4	6	33/9	—	3 11 0
Telegraph Construction	£1	Nil	Nil	35/-	+1/16	—	

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be numbered and abridged and all subsequent proceedings will be taken.

1935

3585. "Electric condensers." Porzellanfabrik Kahla. February 3rd, 1934. (454845.)

4053. "Electric heaters or radiators." B. Thomas, E. Thomas and A. B. Thomas. February 8th, 1935. (454921.)

6768. "Condensers, cables and other electrical devices comprising two conductors separated by a dielectric." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 25th, 1934. (454847.)

7293. "Electrical insulating material." Standard Telephones & Cables, Ltd., and J. K. Webb. March 8th, 1935. (454923.)

10451. "Multiple filament electric lamps." L. C. Edwards. April 4th, 1935. (454852.)

10544. "Electric motor starters." Brookhirst Switchgear, Ltd., and F. Heaton. April 5th, 1935. (454929.)

10663. "Electrical apparatus for igniting charcoal." F. Branney. April 6th, 1935. (454860.)

10880. "Mosaic screens for cathode-ray tubes." C. J. Whilems. April 8th, 1935. (454937.)

11007. "Apparatus for the reception of radio signals." L. R. Merdler and Baird Television, Ltd. April 9th, 1935. (Cognate application 19295/35.) (454945.)

11098. "Transformer for electric-arc welding." E. Fries. April 10th, 1935. (454950.)

11130. "High-frequency coupling devices." Johnson Laboratories, Inc. April 10th, 1934. (454873.)

11131. "Adjustable high-frequency coupling device." Johnson Laboratories, Inc. April 10th, 1934. (455007.)

11155. "Induction furnaces." G. Mars and R. Hirsch. April 10th, 1935. (Convention date not granted.) (454953.)

11160. "Modulated carrier-wave receivers." Marconi's Wireless Telegraph Co., Ltd., and F. M. G. Murphy. April 10th, 1935. (454954.)

11161. "Radio direction-finding and directional-receiving installations." Marconi's Wireless Telegraph Co., Ltd., and S. B. Smith. April 10th, 1935. (454955.)

11162. "Modulated carrier-wave television and like transmitters." Marconi's Wireless Telegraph Co., Ltd., and W. S. L. Tringham. April 10th, 1935. (454956.)

11268. "Electric lamps." British Thomson-Houston Co., Ltd., H. N. Sporborg, L. J. Davies, J. A. V. Fairbrother and D. Gabor. April 11th, 1935. (455009.)

11638. "Devices employing electronic emission." E. E. Wright and Baird Television, Ltd. April 15th, 1935. (454973.)

12311. "Systems of control for electrically operated lifts." General Electric Co., Ltd., N. C. Smart and A. A. Chubb. April 24th, 1935. (454725.)

13298. "Price-change mechanisms for prepayment meters." N. Wright and Metropolitan-Vickers Electrical Co., Ltd. May 3rd, 1935. (454880.)

13318. "Control of relays by means of electrical discharge tube circuits." Radiovisor Parent, Ltd., H. W. Pook and G. A. G. Ive. May 4th, 1935. (Addition to 430439.) (454976.)

13324. "Fusible electric cut-outs." W. T. Henley's Telegraph Works Co., Ltd., and H. W. Breeze. May 11th, 1935. (454977.)

13891. "Fusible electric cut-outs." W. T. Henley's Telegraph Works Co., Ltd., and E. Moor. May 11th, 1935. (454802.)

14848. "Combined incandescent lamp and flasher." J. F. Schmidinger and C. C. Bohner. May 23rd, 1934. (454732.)

15957. "Constructional parts of electric-discharge vessels or like electrical apparatus made from ceramic masses." British Thomson-Houston Co., Ltd. June 1st, 1934. (454803.)

18638. "Metal pulpit or desk reflector with adjustable shutter, for electric incandescent double ended tubular lamps." W. Gudlevsky and H. Gudlevsky (trading as Woolf & Harris). June 29th, 1935. (454681.)

19813. "Multi-way electric switches for use in radio and like circuits." P. R. Mallory & Co., Inc. October 5th, 1934. (454735.)

21795. "Electric switches of the tumbler type." G. E. Crabtree, W. T. Elliott, E. Badham and R. W. Thornton (legal representatives of J. A. Crabtree, dec.). August 1st, 1935. (454865.)

24638. "Means for increasing the insulation breakdown voltage in electrical apparatus." Soc. Italiana Pirelli. January 30th, 1935. (454890.)

25652. "Telephone systems." Siemens Bros. & Co., Ltd., W. H. Grinsted and H. E. Humphries. September 16th, 1935. (Addition to 401394.) (454739.)

31693. "Electric-discharge devices." British Thomson-Houston Co., Ltd. November 16th, 1934. (454817.)

32194. "Electric drive for vehicle axles, in particular of trolley-buses." W. J. Tennant (Tatra Works, Ltd., motor-car and railway carriage and wagon builders). November 20th, 1935. (454818.)

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452. "Thermionic oscillation generators." Standard Telephones & Cables, Ltd. April 25th, 1935. (454902.)

629. "Prevention of blinding or dazzle in electric arc welding." A. Grün. January 11th, 1935. (454823.)

1561. "Tone-control devices for use in connection with radio broadcast or like distribution systems." G. A. Barden and Goodmans (Clerkenwell), Ltd. January 17th, 1936. (454903.)

1943. "Electrode systems having unsymmetrical conductivity." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 9th, 1935. (454826.)

3221. "Electric induction furnaces." L. Russ (née Delmhorst). February 1st, 1935. (454754.)

3324. "Protective relays." Akt.-Ges. Brown, Boveri & Cie. February 4th, 1935. (454755.)

5451. "Electric amplifying tubes." Vereinigte Glühlampen und Elektricitäts Akt.-Ges. April 11th, 1934. (Divided out of 11241/35.) (454760.)

5528. "Photo-electric photographic exposure meters." Metrawatt Akt.-Ges. Fabrik Elektrischer Messgeraete. March 2nd, 1935. (454704.)

5567. "High-frequency signalling apparatus." Marconi's Wireless Telegraph Co., Ltd. February 23rd, 1935. (454831.)

5945. "Signal-translating and modulating systems." Hazeltine Corporation. March 27th, 1935. (454996.)

6347. "Apparatus for the conversion of optical images into electron images." Allgemeine Elektricitäts-Ges. March 1st, 1935. (454832.)

7122. "Illuminating devices comprising liquid-cooled sources of electric illumination." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 20th, 1935. (454906.)

7613. "Electric iron." A. Grossmann. March 13th, 1936. (454908.)

9039. "Cord-holder and take-up for electric irons." E. F. Craig. March 26th, 1936. (454935.)

9429. "Modulated carrier-wave system." Marconi's Wireless Telegraph Co., Ltd. March 30th, 1935. (454709.)

9527. "Electric cooking ovens." Falk, Stadelmann & Co., Ltd., and S. F. Bickell. March 31st, 1936. (454710.)

11081. "High-frequency submarine electric cables." Siemens & Halske Akt.-Ges. July 13th, 1935. (454776.)

11305. "Method of manufacturing photo-electric electrodes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 29th, 1935. (454839.)

13112. "Apparatus for electrolytically decomposing water." Siemens & Halske Akt.-Ges. August 24th, 1935. (454915.)

14779. "Ionic rectifying tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 27th, 1935. (454841.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 28th:—

Mighty Atom. No. 571129. Class 6. Portable electric and pneumatic drilling and screw-driving machines.—Desoutter Bros., Ltd., 73, Baker Street, W.1.

Birwat. No. 569907. Class 8. Signs illuminated by artificial light.—"Birwatt," Ltd., 10, The Broadway, Aldwick Road, Bognor Regis.

Televisor. No. 570728. Cathvisor. No. 570729. Class 8 (letters and designs). Television, telegraphic and telephonic apparatus.—Baird Television, Ltd., 58, Victoria Street, Westminster, S.W.1.

Radeon. No. 570956. Class 8. Signs illuminated by light reflective signs or by internal artificial light.—The Metal Box Co., Ltd., Queen's House, 28, Kingsway, W.C.2.

Covalux. No. 571933. Class 15. Glass reflectors.—Curtis Lighting Co. of Great Britain, Ltd., Aldwych House, Aldwych, W.C.2.

Recovery from Electric Shocks

A SUMMARY of information relating to electric shocks, collected by Mr. Wills Maclachlan in Canada and the United States for the assistance of research workers in the University of Toronto, is given in *Electrotechnics*, the journal of the Electrical Engineering Society, Bangalore (S. India). Mr. Maclachlan believes that much more research and clinical study is required, and that the application of results from laboratory animals to human beings calls for caution. At present it is known that the passage of electric current through a man results in paralysis of the higher nerve centres, causing breathing to stop, preventing normal nervous reflex responses and causing lack of tone in the blood vessels. The heart may be thrown into venticular flutter developing later into ventricular fibrillation, from which recovery is possible. If the fibrillation passes off expulsive beats may be induced by adrenalin, but if the drug is administered before cessation of fibrillation (the only sure test for which is by electro-cardiograph) it will lengthen the fibrillation period.

Chance of recovery is better if the shock contact is of short duration and is followed immediately by artificial respiration, assisted by warmth such as by the use of blankets and hot-water bottles.

Electrical counter-shock has apparently not proved to be of practical value, nor has the administering of oxygen plus carbon-dioxide in the case of laboratory animals. Success in resuscitation is less in hot months, but greater in the middle of the day.

Because of the lack of reflex nervous responses, failure of the normal tests for life should not be taken as evidence of death and artificial respiration (see ELECTRICAL REVIEW dealing with methods of reviving persons who have received a shock) should not be given up for at least four hours, and should be continued until the patient breathes by himself or there are definite signs of *rigor mortis*. Fatal results have sometimes followed the patient's being permitted to sit up or stand immediately after breathing is restored owing to lack of tone of the blood vessels. He should be transported in a lying position.

The author of the article emphasises the need to instruct the staff in artificial respiration by printed details and by regular practice. He instances one large electricity supply undertaking, the employés of which revived as many as 64 per cent. of the cases which they attended to over a period of fifteen years.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Annfield Plain.—Extensions to premises, for the Annfield Plain Industrial Co-operative Society, Ltd.

Barking.—Town hall; H. Jackson & R. Edmonds, architects, Birmingham.

Barnsley (YORKSHIRE).—Laundry, Brierley Common Isolation Hospital, for Hemsworth and Wombwell Joint Hospital Committee; W. T. Lynam, architect, Market Street, Hemsworth.

Becontree.—Factory, Alibon Road; Pullam & Metcalfe, Ltd.

Berkshire.—School, Woodley (£15,400); director of education, Reading.

Bexley.—Cinema, Westwood Lane, Blackfen, for the Blackfen Theatre Co.; secretary.

Birmingham.—Cinema, Bristol Road, Rubery, for T. Hodge, Bristol Road South, Northfield. Factory, George Street, for Taylor & Co.; J. E. Harper & Son, builders, Lombard Street.

Blackwell (NOTTINGHAMSHIRE).—Houses (40) and bungalows, Shirebrook; A. H. Elliott, R.D.C. surveyor, Gilcroft Chambers, Church Lane, Mansfield.

Brentford.—Factory, Great West Road, for Tecalemit, Ltd.

Bridlington.—Houses (65) and bungalows; borough surveyor. Concert hall, Royal Prince's Parade; borough architect.

Cambridgeshire.—School, Impington; County director of education, Cambridge.

Cheshire.—School, Harrytown, Lower Bredbury; County director of education, Chester.

Chester.—Houses (128), Blacon Point estate; T. B. Gorst & Sons. Houses, Lower Park Road; F. C. Saxon, architect.

Coventry.—Extensions to works, for Thornell Owen, Ltd.

Croydon.—Extensions to works, for the Slick Brands, Ltd., Stafford Road.

Cumberland.—School, Maryport, and extensions to Keswick school; G. B. Brown, director of education, Carlisle.

Darton (YORKSHIRE).—Houses (60), Mapplewell; U.D.C. surveyor.

Derby.—Houses (145); C. H. Aslin, borough architect, Gower Street. Aerodrome, Burmaston; borough engineer.

Droitwich.—Extensions to hospital (£32,000); Hospital Board.

Durrington (SUSSEX).—Shops and houses, Arundel Road, for the Stubbs trustees; J. W. Coleman, architect.

Enfield.—Houses (166), Chestnut Road; H. E. Tufton. Houses (293), Enfield Town estate; W. Goodchild & Co. Houses (142), near Palmers Lane; Farebrother, Ellis & Co., 29, Fleet Street, London, E.C.4.

Glasgow.—Laboratories at the Universities; T. H. Hughes, architect, 121, Douglas Street. Extensions to works, for F. Brady & Co., Ltd.

Hampshire.—School, Portchester, for County E.C.

Hastings.—Development of Filsham Farm estate; C. J. Curtis & Co. architects. Front improvements, with sun lounge, &c. (£45,670); borough engineer. Alterations to Plaza Cinema, Robertson Street; H. W. Coussens, architect.

High Wycombe (BUCKINGHAMSHIRE).—Factory, for Castle Bros. (Furniture), Ltd.

Inverness.—Hotel, Bogbain (£30,000), for Colonel P. Mitford, Berryfield, Lentram, director of Lochness Hotels, Ltd.

Keighley.—Extensions to works, for S. Raistrick & Sons, Ltd., Haworth. Ritz Cinema, for the Union Cinema Co., Ltd.; secretary.

Kent.—Schools, North Cray, Eden Bridge and Bexley; director of education, County Hall, Maidstone.

Lancashire.—School, Penketh, for County E.C.

Leatherhead.—Houses, Cleeve Road; J. L. Davies, U.D.C. surveyor.

Leeds.—Offices, &c., for the River Ouse Catchment Board (£54,000); clerk.

Leicester.—Museum and branch library, Belgrave estate; borough engineer. Extensions to works, for the C-operative Printing Society, Ltd.

Littleborough.—Extensions to Isolation hospital; Littleborough, Milnrow & Wardle Joint Board.

Liverpool.—Rebuilding the Liverpool Philharmonic Hall, with electrical work; H. J. Rowse, architect, India Buildings.

London.—(BATTERSEA).—Flour blending factory on the Victoria Granaries site, Vicarage Road; Hal-Williams & Co., architects, 43, Bedford Square, London, W.C.1. (CHELSEA).—Extensions to Carlisle school (£14,359); Triggs & Co., Ltd., Lambourn Works, Mackay Road, S.W.4. (DEPTFORD).—Cinema, for the Odeon Circuit. (GREENWICH).—Cinema, Vanbrugh Hill, electrical work, for Bernstein Theatres, Ltd. (HACKNEY).—Dwellings, Hackney Marshes (£553,000); L.C.C. architect. (HAMMERSMITH).—Church, King Street, for Rivercourt Methodist trustees; Perriam & Son, Regent House, Regent Street, W.1. Town Hall, Riverside Gardens (£200,000); E. Berry Webber, architect, 39, Gordon Square, W.C.1. (LAMBETH).—Tenements, Hemans Street (£36,589); borough engineer. (PADDINGTON).—Eight-storey building, Westbourne Grove and Douglas Place; Shepherd & Thomerson. (POPLAR).—Reconstruction of Wharf Road school; L.C.C. architect. (STEPNEY).—Premises for the London Wholesale Co-operative Society, Great Prescot Street; L. G. Ekins, architect, Leman Street, London, E.1. Tenements, Arbour Square (£38,537); borough engineer. Tenements (168), Red Lion Brewery site (£88,286); Unit Construction Co., Ltd. (WOOLWICH).—Houses (198), Middle Park estate; borough surveyor.

Macclesfield.—Houses (24), Ivy Road and Arlington Drive; C. Ogle, Woodford Road, Poynton.

Maltby (YORKSHIRE).—Houses (120); M. R. Jones, U.D.C. surveyor.

Manchester.—Houses (302), Barton Road, Davyhulme; F. Entwistle, builder, Derbyshire Lane, Stretford.

Mansfield.—Houses (48), Bull Farm estate (£25,000); borough engineer. Houses (21), Norbury Drive; J. P. Smith. Extensions to massage department, General Hospital, West Hill Drive; governors.

Middlesbrough.—Offices for the North-Eastern Daily Gazette, Ltd., Borough Road; Ellis and Clarke, architects, 3, Old Queen Street, London, S.W.1. Additions to Kirby Secondary School, for E.C.; P. B. Haswell, architect, Education Offices, Woodlands Road.

Middleton.—Houses (44), Pilkington Street; D. Horwich, Green Street. Houses (34), Sefton Road, Archer Park, Sunnybrow Road; Lees Estate (Manchester), Ltd., John Dalton Street, Manchester.

Moffat.—Houses, electrical work; Reid & Forbes, architects, 17, Great Stuart Street, Edinburgh.

Newcastle-on-Tyne.—Shops, North Heaton estate; Wilkinson Brothers, builders, Huntcliffe Gardens.

Oldbury.—Offices and works, Tat Bank Road; Cox & Danks, Ltd.

Olton (WARWICKSHIRE).—Houses (1,600) on 300-acre site, for the Ideal Benefit Society, Pitmaston, Russell Road, Birmingham; Beard, Bennett & Cooper, architects, 177, Corporation Street, Birmingham.

Penzance.—Houses, Gwavas estate (£79,191); E. Dennis & Son, builders, Camelford.

Ponders End.—Houses (30), Falcon Crescent; W. M. Edwards. Showrooms, High Street; Ley, Colbeck & Partners.

Renfrew.—Extensions to Renfrew Aerodrome (£20,000); town clerk.

Ross (HEREFORDSHIRE).—Houses (80); F. Evan Davoll, architect.

Salisbury.—Cinema (electrical work), Fisherton Street, for the Gaumont British Corporation, Ltd., Film House, Wardour Street, London, W.1.

Scarborough.—Conversion of premises, Prince of Wales Terrace, into private hotel, and offices, Scalby Road, for Bird, Ltd.; T. W. Whipp, architect, 15, Valley Bridge Parade.

Shildon.—Houses; North-Eastern Housing Association, Ltd., Northumberland Road, Newcastle-on-Tyne.

Shipley.—Houses (36), Low Ash Road; Wrose Hill Estate Co., Ltd. Extensions to works, Wrose Brow Road; Lee & Crabtree.

Sidcup.—Schools, for the R.C. managers; secretary.

Smethwick.—Houses (150), Quinton; borough surveyor.

Southall.—School, Lady Margaret Road (£28,606); E. Plaistowe & Sons, Ltd., South Road.

Southgate.—Flats and houses, Council estate; borough engineer.

Southport.—Dining hall, Technical college; Cruickshank & Seward, architects. Alterations to Coliseum cinema, Nevill Street; Coliseum (Southport), Ltd.

South Shields.—Library; borough engineer.

Staffordshire.—Schools, Biddulph, Wednesfield, Leek, Newcastle; Great Wyrley; County director of education, Stafford.

Stainton (YORKSHIRE).—Houses (23), for T. G. Pearson.

Stirling.—Works, Main Street, St. Ninians, for A. J. Arthur, 21, Manse Crescent.

Stonehouse (GLOUCESTERSHIRE).—Cinema, electrical work, for A. J. Stratford.

Stourbridge.—Offices, showrooms, &c., for Hewitts' Garages, Ltd., High Street, Amblecote; T. S. Beach, architect, 5, New Road, Halesowen.

Sunderland.—Church, Ford estate, for the Wearmouth Deanery Ruridecanal Conference; Canon E. Jackson, St. John's Vicarage, Sunderland.

Surrey.—Nurses' home, Epsom (£66,780), for C.C.; clerk, Kingston-on-Thames. Reconstruction of Knaphill school, Woking (£21,794); county architect.

Swindon.—Development of Gorse Hill estate; Stanford & Co.

Templeborough.—Factory, for the Sheffield Steel Products, Ltd.

Tenterden (KENT).—Houses (38); R.D.C. surveyor.

Thornaby-on-Tees.—Swimming baths, Thornaby Road; borough engineer.

Tonbridge.—Houses (48), Little Trench estate; B. Bishop, U.D.C. surveyor.

Twickenham.—Houses (30), near Nelson Road; Bayes and Bishop, architects, 6, Pownall Gardens, Hounslow.

Uckfield (SUSSEX).—Cinema, for Daryl Klein.

Ulverston.—Cinema, Brogden Street; J. W. Gomersall, architect, Manchester.

Wallasey.—School, Coronation Avenue (£39,503), for E.C.

Walsall.—Houses (117), Harden North site; J. Taylor, borough engineer. Extensions to works, for the Latham Manufacturing Co., 4, Ablewell Street.

Welwyn.—Cinema, London Road; H. A. Ward, architect.

West Molesey.—Church presbytery, parish hall and elementary school, Island Farm estate; R.C. Authorities.

Weymouth.—Houses (140), Goldcroft estate (£50,262); James Bros.

Wolverhampton.—Houses (52), near Hollybush Lane; A. M. Griffiths & Son, Ltd. Houses (72), Vicarage estate, Prestwood Road; Bushbury Estate & Building Co. Factory, Green Lane, Pastori & Cassnove.

Wigan.—Factory, Wigan Lane, for Robert Alstead, Ltd., Woodcock Street.

Worcestershire.—School, Bromsgrove Road, Redditch, for County E.C. School, Hagley, for County E.C.; A. W. Priestley, director of education, Worcester.

Worthing.—Houses (109), Sackville Road; S. C. Phillips.

Yorkshire.—School, Thorne Moorends, for West Riding E.C.; education architect, Wakefield.